ISLAND COLONISATION AND ABANDONMENT IN MEDITERRANEAN PREHISTORY

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ABSTRACT

This thesis studies the colonisation and abandonment of Mediterranean islands in prehistory by placing them within a comparative framework. The geographical scope is pan-Mediterranean and chronologically it encompasses prehistory from the time when the earliest-known human records are found on a few islands to the time when most Mediterranean islands had been colonised (approximately from the end of the Pleistocene to the end of the Iron Age). By questioning established geographical boundaries and chronological restrictions and by incorporating recent theoretical advances in island archaeology, this thesis provides alternative explanations to colonisation paradigms prevalent in the 1980s and 1990s, expanding these to include considerations of abandonment and recolonisation. After investigating leading theoretical approaches to colonisation and abandonment, the study reviews the bulk of available publications on Mediterranean island-based projects from the past ten years, and presents a series of revised colonisation and abandonment dates and models for the islands. At a broader level, these new data indicate the need for clearer distinctions between different types of island-human interaction (e.g. visitation, utilisation, occupation, establishment, abandonment, and re-colonisation). The thesis therefore also analyses - through a series of case studies - how human activity on islands varied spatially and temporally and potential reasons behind different colonisation and abandonment processes. The resulting observations are placed against the backdrop of the changing palaeogeography of the prehistoric Mediterranean, by taking into account changes in sea levels and in the islands' environments, and contextualised within the broader scheme of reference of Mediterranean prehistory.

TABLE OF CONTENTS

LIST OF ILLUSTRATIONS

CHAPTER 2

CHAPTER 3

CHAPTER 4

CHAPTER 7

LIST OF TABLES

CHAPTER 2

CHAPTER 4

CHAPTER 5

CHAPTER 7

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CHAPTER 1

INTRODUCTION

This thesis is a study of the colonisation and abandonment of Mediterranean islands in prehistory. The archaeology of Mediterranean island is a growing area of research, and one that, while born from approaches devised for other areas of the world, is increasingly developing its own character. Island archaeology in general has recently emerged as a significant field for the development of world archaeological theory: key strengths are that it encourages productive comparisons between data and models derived from different islands and periods and that it deals with the archaeology both of isolation and of interaction (Broodbank 2000; Waldren and Ensenyat eds 2002; Fitzpatrick ed. 2004; Rainbird 2004). Over the years, islands across the globe have been claimed to provide ideal 'laboratories' for studying ecosystems and societies (Vayda and Rappaport 1963; MacArthur and Wilson 1967; Evans 1973, 1977; Terrell *et al.* 1997) and to illustrate lessons about environmental overexploitation (Bahn and Flenley 1992; Kirch and Hunt 1997) and demographic change (McArthur *et al.* 1976; Black 1978; Williamson and Sabath 1984; Paine 1997). Recent regional studies of islands have combined a number of theoretical and practical approaches and brought detailed and synthetic focus to the subject (Patton 1996; Bass 1998; Broodbank 2000; Cooper 2002; Rainbird 2004).

A number of approaches fall under the label 'island archaeology', which broadly speaking is a theoretical and analytical framework of comparison that recognises a number of common themes and pursues questions that are pertinent to islands. This framework is highly adaptable to the archaeology of individual islands and archipelagos, and to their relation (and comparison) with mainland cultures (cf. Anderson 2004; Renfrew 2004). The comparison of island cultures points increasingly to isolation and interaction being culturally structured features that are not necessarily fixed in time by geographical variables. Islands are convenient units of analysis that can be compared, but their geographical characteristics (e.g. size, distance, and resources) are mediated through culture-specific lenses: this can be seen in the historical trajectories of human communities on islands and archipelagos, and their alternating centrality and marginality (e.g. ways in which changes in technology can be used to overcome distance and lack of resources or affect the perception of travel).

Several specialist interests fall under the broad remit of island archaeology, such as the archaeology of expansion, colonisation, refuge, abandonment, resettlement, subsistence, and so on. Because of the comparative nature of the field, archaeologists working with islands engage with great diversity and have identified a set of analytical categories and developed an effective vocabulary to refer to these: terms, such as 'island' effect (usually associated with isolated habitats on mainlands), 'founder' effect, 'commuter' effect, 'super-attractors', 'nurseries', 'stepping-stone' effect, 'islandscape', 'seascape', etc. (discussed in Chapter 3), which are now regularly to be found in island-related publications, in order to explain concepts derived from island archaeology. These concepts draw on wider archaeological theories, e.g. culture evolution and ecosystem approaches, but frame broad questions within specific spatial variables and investigate whether these variables have a measurable effect on the development of culture and how this effect varies over time and space.

Island archaeology thus contributes to the study of prehistory in general, by testing questions relating to migration, colonisation, human/environmental interaction, domestication, cultural diversification, etc. within specific parameters (in this case those afforded by islands): this characteristic finds parallels with other specialisms employing comparative frameworks (e.g. gender archaeology, the archaeology of power, social complexity, state formation, etc.). As Anderson recently put it, island archaeology is 'separable but not separate from the wider discipline' (2004: 267), i.e. island archaeological research has much to contribute to non-island related studies of the past. Apart from framing general questions asked by prehistorians within an island setting, island archaeology is also developing its own questions: e.g. how does insularity (or how do specific geographical characteristics) affect culture and vice versa? Is being/living on an island 'neutral' (Sheppard pers. comm.)? What are the effects of changes in palaeogeography or of islands becoming islands?

While island archaeologists are developing their own questions and vocabulary, they have also retained some generic terms borrowed from prehistory. The terms colonisation and abandonment are a case in point: their use is in need of refinement, as a number of rather distinct activities fall under these labels. Here lies an important potential development of island archaeology: achieving clearer understanding of these activities through the analysis of archaeological assemblages found on islands and the identification of diagnostic remains or material correlates for each of these activities. Palaeoenvironmental data can be used effectively to understand exploration while other data (e.g. changes in material culture) can give indications as to whether dispersal was slow and colonisation rapid, gradual, or purposive; in general, such data can help us to understand issues of settlement, adaptation, viability, population dynamics, and cultural networks.

More than twenty years have passed since Cherry first synthesised the colonisation data available at the time and formulated a theoretical and practical framework for studying colonisation in the Mediterranean islands (1981). That initial review was followed by an update almost ten years later (Cherry 1990), but while the body of island data has continued to grow and there have been considerable advances in the theory of island archaeology, theory and practice have rarely been brought together again as equal players in the Mediterranean (most recently by Broodbank 2000). Patton's study favoured a theoretical approach (1996), Gaffney *et al.* (1997) had a more practical remit, and Bass (1998), while developing a solid theoretical framework amply supported by observations drawn from the archaeological record, had a regional focus (though its relevance exceeded those spatial limits).

The questions posed by island archaeology must be adapted to make them relevant to different settings. Empirical data and their context set the pitch as to the issues that may be addressed, leading to the identification of a series of questions that are specifically 'Mediterranean'. Spatial analysis, for example, is a key theme of island archaeology, but it has to be customised to the configuration of the regions in question and the questions being asked. Biogeographical approaches developed elsewhere should not be rejected, but considerably adjusted if they are to be applied effectively to the

Mediterranean islands. Mediterranean configuration would suggest that island life should have developed here more readily than in areas where islands are more remote. In reality, however, this was not always the case, and the development of island life was only superficially a cumulative process. In fact, in the Mediterranean it is impossible to discuss island colonisation without taking abandonment into consideration, since this was (and still is) a fundamental component of island life. However, despite the fact that islands were repeatedly abandoned and recolonised, there is still an imbalance in the amount of research that has gone into understanding colonisation and abandonment, the latter being largely overlooked. This discrepancy needs to be addressed.

This research project deals with island colonisation and abandonment at different levels. It is argued throughout that the physical and social make-ups of islands are inseparable features, but that they have to be deconstructed, i.e. their meanings separated to an extent, if they are to be fully gauged. Mediterranean islands offer a wide spectrum of physical and cultural elements that combine to create the diversity that characterises this region; at the same time, some regular features can be identified, and it is on these that the study focuses at first. Geographical and environmental data thus provide the first port of call in this study, and present the setting (both in terms of restrictions and opportunities) for understanding the unfolding of the processes being investigated. The geographical scope of the study is at first pan-Mediterranean, but once common Mediterranean underlying features are identified, the thesis moves on to address why island regions developed in either similar or different ways, by focusing on increasingly fine scales of enquiry, highlighting variations and similarities within the processes, at a regional scale and then at the level of individual islands.

This study is also conducted at different chronological levels. The overall chronological breadth of the analysis encompasses prehistory from the end of the Pleistocene to the Iron Age. This scope takes into account many colonisation and abandonment events/processes, from the first time that human presence is recorded on any island to the time when it is documented on most of them. It is of course rare that the development of an island can be followed through a period of ten thousand years, but by combining data from different islands, regional patterns do emerge over long time periods, while the data from the individual islands afford a series of snapshots of the making of such patterns. The project thus investigates what colonisation and abandonment processes entail in different spatial and temporal settings, and whether, and to what degree, sequences of colonisation and abandonment in separate parts of the Mediterranean are interconnected. Their chronological and spatial variation (often within the same archipelago), and potential reasons behind these, are also explored, and suggestions are made with regard to social interaction between different island regions.

Cherry (2004: 236) has recently claimed that, because of the vastness of the data now available, 'syntheses of Mediterranean prehistory as a whole are [thus] rare (e.g. Trump 1980; Patton 1996), and generally disappointing'. The comment is partly justified, as these studies have taken on the immense task of amalgamating human histories spanning several millennia, and therefore succumb to '*ex cathedra* generalization' (Cherry 2004: 243). This thesis strives to differ from previous syntheses, by making a contribution to the discourse of Mediterranean prehistory through a study of specific aspects of island life. It aims to provide a theoretical framework for comparison between island regions to oppose the increasing 'segmentation and hyperspecialisation' of Mediterranean studies that Cherry equally stigmatises (*ibid.*).

This work addresses the changing nature of colonisation and abandonment in the Mediterranean islands by making the most of switching between different scales of enquiry. The sources of the data used to support this investigation are necessarily highly eclectic, as they are derived from archaeological publications that date from the start of the twentieth century to the present day. This is interesting in its own right, as it affords an insight into how island studies have evolved in this area over the past century. However, it also presents several challenges and can be frustrating, as the data were originally collected and interpreted according to different research agendas, and thus may be lacking in some respects that would be useful to this project. Nonetheless, while this study cannot always offer a full picture of the processes under examination in discrete areas, individual parts do concur to create a coherent whole thanks to the wide spatial and chronological scope. This does not mean that gaps are glossed over - on the contrary, negative evidence is constantly checked and its relevance contextualised. Capitalising on all the evidence available is important if we are to clarify the dynamics behind the development of island societies, which in turn will provide crucial elements to understanding a wholly Mediterranean way of life.

The thesis begins by offering a detailed description of the Mediterranean environment and its islands, and their prehistoric configuration (Chapter 2). Attention is paid to changing coastal morphology, and some regions are studied in detail through a series of maps showing the islands at different sea levels. These changes are then analysed in terms of land and resources lost to rising sea levels and their potential effects on the islands and their occupants. Reconstructing sea levels at different moments in prehistory is particularly important, since sea level changes occurred in some cases over limited time spans, raising the question as to what is the significance of territories being or becoming islands.

The following step is an appraisal of different theories concerning island colonisation and an assessment of how they have informed approaches to Mediterranean island colonisation specifically. Chapter 3 begins by reviewing island biogeography (both traditional and new approaches). Cherry's (1981, 1990) work on the colonisation of Mediterranean islands is considered in particular detail, because of its influence on subsequent studies, and its continuing relevance is gauged in the light of other colonisation and migration theories, and also of recent developments in the area of DNA studies of prehistoric populations. Phoenician and Greek expansion within the Mediterranean are contrasted and discussed as offering examples of different (often interchangeable) kinds of colonisation (e.g. 'activity-driven' vs. 'residence-driven' colonisation), and of the corresponding types of evidence that have been taken to represent them in the archaeological record.

Speaking about "What's different and what's new" in Mediterranean island prehistory, Cherry (2004: 239) has recently concluded that the issue as to 'what we mean by "colonization", as distinct from discovery, exploration, occupation, establishment, utilization...' is still unresolved. This chapter digs further into this subject, and focuses on similar questions: is permanent settlement "colonisation", or should we think in terms of different types (or phases) of colonisation, which are related to different activities and aims? Throughout this discussion, linear approaches to island colonisation (in which human activity on islands is seen as largely geared towards settlement) are contrasted with a punctuated view of island-human interaction, where different activities (or phases) form a broader 'colonisation' category.

This theoretical review of colonisation also prompts a discussion on the nature of islands and insularity, and whether the colonisation of islands is different from that of any other territory. Evidence would suggest that it is, since generally speaking islands were settled later than mainland territories, although this may be more a reflection of the type of evidence that researchers have been seeking and of the meaning given to 'colonisation'. As to the nature of islands themselves, approaches now tend to emphasise that, unlike truly isolated habitats, islands should no longer be treated as pristine 'laboratories' (as they were originally by MacArthur and Wilson 1967 and Evans 1973). The idea of the 'islandscape' (Broodbank 2000: 21) takes into account the combined effect of different geographical variables (such as island configuration and the geographical distribution of resources), emphasising that islands should not be viewed as isolated units. Importantly, this approach also considers the human experience of space, providing a much more sophisticated avenue for understanding human geography and cultural development in the Mediterranean (and island regions elsewhere). The 'islandscape' is elaborated on further in the course of the chapter, through the development of the 'extended island' concept, which, on analogy with an extended family, refers not just to the island and the space that extends beyond it but also to the people who inhabit it. This discussion emphasises that we should focus not just on the objective environment, but also on the people and their perception of the environment (e.g. in terms of whether resources are deemed sufficient), and of what constitutes a sustainable community (as seen objectively through demographic modelling, but also through the lens of culture-specific perception).

This theoretical discussion sets the scene for Chapter 4, which is the review of colonisation data from the Mediterranean islands. Cherry's 1990 evaluation of island colonisation data forms the initial basis of this chapter. However, his list is amended in the light of discoveries that have taken place in the past fifteen years, and data from islands that he did not include in either of his reviews (i.e. the Dalmatian and the North African islands) are also examined. Although traditional geographic distinctions are respected by the review in Chapter 4, the west-east divide has been deliberately omitted, as the analysis proceeds smoothly from west to east (this is arbitrary, and for convenience' sake it could equally have started at the other end). While the spatial analysis progresses gradually eastwards, chronologically the review proceeds of necessity somewhat erratically towards some of the earliest colonisation dates, via early colonisation dates in the west.

Data from the islands are inevitably described in differing amounts of detail, depending on the level of research conducted there, but particular attention is paid to islands whose colonisation is still surrounded by controversy, e.g. the Balearics and, to a lesser extent, Sardinia. The database for this chapter (Tables 5.1 and 5.2) also shows the increasing evidence of human presence on Mediterranean islands before the Neolithic. The effects of differential exploration are considered, and new island groups, which were not included in Cherry's pan-Mediterranean review (with consequences that will be explored), are also included in the study. While Cherry's sample was predominantly eastern Mediterranean (it included 78 islands in the eastern Mediterranean and 34 in the western Mediterranean), the database for this study contains data from 83 islands from the east and 62 from the west (i.e. almost twice as many as Cherry's 1990 western sample). As part of this review, all uncalibrated dates from survey and excavation publications and reports consulted have been calibrated to allow cross-referencing and comparison by using Stuiver and Pearson's calibration curve (1993).

This chapter is more than just a resource document: the review of published data from surveys and excavation reports highlights the fact that these projects reflect different research agendas and strategies and that, consequently, material remains have also been interpreted in different ways. This makes it a challenge to translate the archaeological record into a coherent set of corresponding human activities. Different material remains found on the islands are therefore considered in this study by evaluating their significance in relation to their location, distribution, intensity, and combinations thereof. Classes of material (structures, settlements, burial, lithics, pottery, animal and plant remains) can be tied to different areas of activity (subsistence, technology, settlement, ideology, exchange) and, based on their intensity, to different phases within these (initial, established, final). However, the case studies also reveal a great deal of overlapping (burial, for example, can be linked both to settlement and to repeated visitation), so potential misinterpretations in the publications are also singled out.

Evidence for visitation is particularly hard to pick up in the record. To make things worse, researchers have tended to group all ephemeral remains, which they feel cannot be equated to permanent occupation, under what is considered a preliminary phase. Rather than relating fixed categories of objects to different human activities on the islands (as suggested by Cherry 1981, 1990 and Vigne 1989), it is proposed that relations between activities and 'diagnostics' should be supported by evidence from individual sites, and only subsequently different combinations of material remains be used to address human activity in a comparative way.

In Chapter 5, colonisation data are analysed statistically. This is done initially by updating Cherry's 1981 'cumulative colonisation graph' of Mediterranean island colonisation (which provided the basis for his colonisation model) in the light of the data discussed in Chapter 4. The discussion of this graph highlights two points: firstly the need to look at patterns of regional rather than pan-Mediterranean development, and secondly the fact that there are problems with viewing colonisation as a cumulative process. A non-cumulative plot of Mediterranean island colonisation is offered as a valid alternative, which, rather than adding the number of islands colonised in the previous millennium to the following, takes into account only how many new colonisation events take place during each millennium. This graph will be discussed in detail in Chapter 5, but, to anticipate the argument, it allows us to compare rates of colonisation between millennia, and highlights much more effectively the 'ups-and-downs' of Mediterranean island colonisation. As mentioned, the graph is based on different types of data and thus, rather than representing only permanent settlement, it gives a representation of how human activity (including settlement) varies spatially and temporally (though settlement data form the majority of the evidence reviewed). This is not a problem; on the contrary, it gives a much fairer representation of how human activity can vary, often within the same period or archipelago, since certain distinctions between phases allegedly leading to settlement may be rigid and/or arbitrary creations. The same type of graph is compiled for individual island groups, and differences and similarities in the human use of distinct island regions at different ends of the Mediterranean are then compared and investigated.

Statistical analysis is a useful tool for comparison between regions but it can also conceal important nuances, and this quantitative work is thus complemented by qualitative analysis. This leads to a redefinition of these phases and to the formulation of alternative ways of viewing colonisation, which are offered as a critique of prevailing theoretical paradigms. These alternative ways include looking at colonisation by emphasising time (can we distinguish between Palaeolithic, Mesolithic, Neolithic, Bronze, and Iron Age colonisation? Do the patterns point towards such arbitrary/useful distinctions?), area (by addressing configuration and changes in the palaeogeography of the islands), and types of activity. Individual sites from different islands and periods are studied in detail in order to illustrate various types of colonisation and the material remains that might represent such activities. The chapter investigates whether there are any links between certain activities and periods, and, therefore, if colonisation changes over time (e.g. can 'utilisation' in certain periods qualify as 'colonisation' in others?). This new view of colonisation will also highlight its irregular nature, thus preparing the way to a discussion of island abandonment.

Abandonment is reviewed from a theoretical perspective in Chapter 6. While there is a substantial body of literature on the colonisation of Mediterranean islands, abandonment has been largely overlooked. Therefore, this chapter draws on a number of studies developed in different geographical areas and periods (e.g. the Aleutian Islands, the Southern Pacific Islands, and the historic American south-west) and considers different theoretical approaches to the subject. Particular attention is paid to the role played by the environment, resources and demography, both in objective and subjective terms (by looking at ethnographic studies that focus on human perception and response to changes in these categories). As a result of this discussion, abandonment emerges as a composite process and a complex strategy, contributing, although it may appear counter-intuitive, to island life being continuous when viewed overall. The chapter investigates whether island abandonment is intrinsically 'different' from any other kind of regional abandonment and concludes that it is not, since islands can undergo different types of abandonment, which find parallels in mainland situations, and which, once again, are related to different kinds of activities.

These ideas are explored further in Chapter 7, which deals with specific case studies from the Mediterranean islands. Identifying different types of abandonment based on the studies reviewed in the previous chapter is made difficult by discontinuities in the archaeological record, which may be real or the result of lack of research. Therefore, a sample of *circa* twenty islands (i.e. over 10% of the database) have been selected in view of their good archaeological record. The islands are treated initially as individual units of study, and then comparatively. Abandonment is reconstructed at different scales, at the level of the individual site, island, and island group. Different activities are investigated, and islands that experienced abandonment and recolonisation are contrasted to those where the occupation record is continuous. The role of size, distance and resources is investigated through a series of studies, by contrasting average occupation periods to average abandonment periods in different sites, islands, and groups of islands, and relating these to the categories under study. These studies aim to reconstruct the occupational histories of a selection of islands and to assess whether occupation or abandonment are the norm in island life, or indeed if such a norm exists.

Finally, in Chapter 8, the results and observations of the quantitative and qualitative analyses of colonisation and abandonment from different island groups are drawn together. It is argued that, by studying the two processes in parallel, colonisation and abandonment can shed light on each other, as they both involve change at different levels of interaction, allowing factors that may be promoting them to be identified. The chapter emphasises that a study of islands must include not just initial colonisation, but also abandonment and recolonisation. Finally, it discusses the advantages of bringing an island archaeology theoretical framework to the study of Mediterranean prehistory.

Recently, Cherry (2004: 240) has claimed that the empirical evidence for island colonisation indicates that the 'main outlines of the picture have changed only in minor ways in recent years'. He argues very much along the same lines as he did fifteen years ago: that island colonisation follows biogeographical predictions, but that it shows a great degree of "noise" (*ibid.*). Cherry first spoke of this "noise" in 1981, and explained it by the fact that biogeography did not take into account specifically Mediterranean factors (such as stepping-stone islands, shorter sea crossings, lack of obvious corridors for migration, and other contingent factors). He concluded that human agency must be responsible for the time lag between mainland and island colonisation (Cherry 2004: 241). However, while biogeography has become increasingly refined by taking into account this level of spatial finesse and by introducing cultural variables, the "noise" has remained. The longevity of this "noise" (it was first noted almost twenty-five years ago), far from being a nuisance, should encourage us to step back and look at the data differently.

This work aims to make a contribution to the study of Mediterranean prehistory, by bringing in an island archaeology theoretical framework. This is achieved by exploring different possible statistical combinations of geographical and archaeological data and by complementing these with detail-rich island narratives. The use of different scales for viewing the islands, both traditional (e.g. islands as units) and new (e.g. 'extended' islands), and the zooming in and out of the pan-Mediterranean frame of reference also provide ways of bridging the two subjects. Understanding island colonisation and abandonment involves studying the Mediterranean at both the geographical and historical level. It entails examining different sets of evidence (environmental, archaeological and ethno-historical), and thus is relevant to several fields of study.

As mentioned at the start of this introduction, island archaeology is an evolving subject: new theoretical frameworks are developing and more data are becoming available as research continues to progress also in other fields, allowing researchers to address old and new questions in different ways.

Archaeological emphasis continues to shift and views alter over the relationship between humans and the environment, a relationship that is problematic in some ways and still changing today, as seen by the abandonment of several small Mediterranean islands in the present. This work strives to capture the core of this shifting relationship, by revealing the opportunities and restrictions imposed by islands, but also, when the detail of individual island histories allows this to emerge, the prominent role played by humans in forging a social space for themselves. This is carried out in the belief that the detail afforded by linking together the short-term history of several islands will make a contribution towards the understanding of long-term human history in the Mediterranean, and that comparative analysis is one of the best ways of achieving this.

CHAPTER 2

THE MEDITERRANEAN

The aim of this chapter is to discuss the Mediterranean palaeoenvironment with specific reference to islands and coasts and to highlight the presence of a series of underlying geographical features that will provide useful analytical categories in the following studies. The discussion will also offer an insight into possible types of interaction between humans and island environments in light of the potential of maritime technology, which will be examined further in relevant chapters.

The chapter begins with an introduction to the Mediterranean area, and is aimed at establishing whether a 'Mediterranean landscape' really exists (in the past and/or now), or whether the Mediterranean area is best understood as a collection of different landscapes. This review then focuses on one specific type of landscape found in the Mediterranean, i.e. the island component, and investigates its potential relations with other Mediterranean landscapes by looking at the limitations and opportunities linked to island life. This is followed by a section on the palaeogeography of the Mediterranean region and a reconstruction of ancient coastlines. Shackleton *et al.* have explained how palaeogeography can be used effectively to study the probability of early human presence on islands and the development of human movement and site distribution (which may be linked to area and resources), but also basic concepts such as territory and boundary (1984: 312). Cherry has claimed that 'ultimately [palaeogeography] may offer an insight into possible motivations involved in island colonisation' (1990: 194).

Reconstructing the ancient environment is thus crucial to modelling island colonisation dynamics appropriately. Analysing changes in shorelines highlights the potential deficit of coastal sites (both on the mainland and the islands), a loss which may potentially have distorted our understanding of the timing and nature of island colonisation itself (Cherry 1990: 201). A series of maps of some of the islands at different sea levels is studied in this light, describing the changing landscape of the islands and thus providing the physical backdrop to the colonisation data that will be described in the following chapter. These include maps of the Balearic and Adriatic islands. Finally, the chapter reviews the scope of maritime transport in prehistoric times.

THE MEDITERRANEAN LANDSCAPE

The Mediterranean sea covers an area of about 2,969,000 sq. km, roughly measuring 3,800 km from east to west (from Gibraltar to Lebanon), and varying in width from ca. 740 km (Marseilles to Algiers), to ca. 200 km (Sicily to Tunisia), to ca. 400 km (southern Greece to Libya) (Blondel and Aronson 1999: 7). Known in antiquity as *Mare Mediterraneum* (or 'sea among the lands'), the Mediterranean is 'the largest inland sea of the world' (Blondel and Aronson 1999: 9) (Figs. 2.1, 2.2).

Tides in the Mediterranean are in the order of just 20-30 cm, except at Gibraltar (1 m), and around the island of Jerba (Tunisia) (up to 3 m) (Flemming 1992: 246; Blondel and Aronson 1999: 9). The prevailing winds are the Tramontana (NW-NE), the Bora-Grecale, and the Etessian or Meltemi (NE), the Levanter (E), the Khamsin, Ghibleh, Scirocco, and Marin (SE), the Libeccio (SW), the Vandeval (W), and the Mistral or Maestral (NW). According to Giardino, all of these winds are unpredictable both in strength and direction (1995: 269). The Mediterranean can be subdivided into sub-basins depending on where different currents prevail (generally changing between summer and winter from clockwise to anticlockwise). These basins are: the Hesperian circuit (between Iberia, southern France, and Algeria), the Tyrrhenian circuit (between western Italy, Sardinia, Corsica, and northern Sicily), the Ionian circuit (between southern Italy, Libya, Albania, and the Peloponnese), and the Levantine circuit (between Egypt, the Levantine coast, Turkey, and southern Crete) (Giardino 1995: 272).

The coastline of the northern peninsulas and the major islands defines other 'interior seas' (Blondel and Aronson 1999: 9): the Balearic/Alboran Sea (between the Balearic/Alboran islands and mainland Spain/Morocco), the Tyrrhenian Sea (between Corsica/Sardinia/Sicily and mainland Italy), the Adriatic and Ionian Seas (between Italy and Croatia/Albania/Greece), and the Aegean Sea (between Greece and the Anatolian peninsula) (*ibid.*). The southern coastline, on the other hand, is very linear, except for the Cap Bon peninsula (Tunisia). The Libyan coastline stretches for about 1900 km, offering a coastal lowland with lagoons and salt pans ('sabkhas'); the lowland coast of Tunisia extends for about 1300 km; while the Algerian coast (ca. 1100 km long) has little coastal lowland and is bordered by steep mountains (Jelgersma and Sestini 1999: 295-6). In the present, population density along the north African coast varies greatly, from more than 1000 people/km sq. in the Nile Delta to fewer than 20/km sq. along the coast of Libya (Milliman *et al.* 1992: 5).

The Mediterranean coastline overall is 47,000 km in length, of which ca. 40% (ca. 17-18,000 km) consists of islands (Greek islands: 7700 km; Croatian: 4024 km; Italian: 3766 km; Spanish: 910 km; French/Corsica: 1047 km) (Blondel and Aronson 1999: 12). There are ca. 5000 islands and islets, covering a combined area of 103,000 sq. km (*ibid.*). In view of these figures, King and Kolodny have stated that 'Mediterranean insularity has a quasi-continental form' (2001: 237). Insularity varies within the Mediterranean between extremes, with the Croatian islands popularly referred to as 'Mediterranean Scandinavia' (in view of its thousands of small islets and fjords) (Fig. 2.3), and the largest Italian islands being much more akin to 'continental' landmasses (Fig. 2.4).

Because of its sheer size and diversity, geographers and ecologists alike have raised the question as to whether a 'Mediterranean landscape' really exists, or whether the Mediterranean area should be viewed as a collection of different landscapes (Manzi 2001: 200), or as a 'regional tapestry' (Blondel and Aronson 1999: 90). Grove (a geographer) and Rackham (a botanist and ecological historian) have claimed that, in view of its diversity, 'the Mediterranean is no place for facile generalization' (2001: 12); similarly, Blondel (a biogeographer and animal ecologist) and Aronson (a plant ecologist) defined the Mediterranean basin as an ecological 'patchwork' (1999: 112), which is best understood in terms of climate, soil and vegetation (1999: 16; also Bolle 2003: 14).

In their description of the Mediterranean region, Blondel and Aronson (1999) began by remarking on a distinction between two main ecological zones, divided roughly at the Sicily-Cap Bon line: the area west of the divide is more similar to central Europe (more boreal), whereas the area to the east is more similar to Central Asia (1999: 7). This is a very general distinction and they then make the point that, since the land within/around the Mediterranean is mostly mountainous, the area is best understood as a succession of 'life zones' or 'elevational belts', where similar flora and fauna tend to occur together (Blondel and Aronson 1999: 91). This has the important consequence that the Mediterranean environment is perhaps better understood in vertical rather than horizontal terms. Blondel and Aronson distinguish between eight bands based on elevation, ranging from the lowest ('infra-Mediterranean') to the highest ('cryo-Mediterranean') (1999: 91-95).

The Dalmatian islands fall mainly within a Meso-Mediterranean band (i.e. elevation band 3), while the Ionian islands display both Thermo- and Meso-Mediterranean characteristics (i.e. bands 2 and 3) (Blondel and Aronson 1999: 94, see Fig. 2.5). Several islands have elevations of 1000 m and more (see Table 2.1): these include the larger ones (e.g. Sicily, Sardinia, Corsica, Crete, and Cyprus), but also some very small ones (e.g. Elba and Samothraki), which display several of these 'environmental belts' in close succession. It is worth contrasting the maximum altitude of Sardinia (1834 m) with that of Samothraki (1611 m). The two are comparable, but Sardinia is a landmass of some 24,000 sq. km, whereas Samothraki barely reaches 180 sq. km. Blondel and Aronson state that, on average, the distance between sea and mountains in the Mediterranean area is 100 km, thus these bands are often compressed, and, to complicate things further, can be further dissected into smaller 'catchments' by intervening mountains (1999: 95). They conclude that Mediterranean ecological diversity exists 'regardless of the scale of observation' (1999: 111). This point is highly relevant to a study of islands, as it highlights the fact that an island's elevation has an effect on its ecological diversity, while its size affects the distribution and prominence of these ecozones.

Mediterranean Climate

The Mediterranean climate is 'bimodal', alternating dry hot summers with wet cold winters (Blondel and Aronson 1999: 16; Bolle 2003: 8). Although there has been a succession of cold (glacial) and warm (interglacial) events during the Pleistocene, this pattern dates back to the late Pliocene and is thought to have become established ca. 2,8 M yr BP (Blondel and Aronson 1999: 21, 26). The Mediterranean also lends its name to a type of climate which is found elsewhere in the world, between 30-35° and 40-43° latitude, in South Africa (Cape Province), central Chile, Mexico, USA (central and southern California) and two separate areas in southern Australia (S and SW) (Blondel and Aronson 1999: 84; Grove and Rackham 2001: 11; Bolle 2003: 8).

An important similarity between the 'Mediterranean-type' areas is in their vegetation, with evergreen sclerophyllous trees and shrubs prevailing overall (in response to the bimodal climate). However, the 'understorey' plants vary greatly, owing to the different soils in these regions (soils in the Mediterranean are predominantly made of limestone) (Blondel and Aronson 1999: 87). There are other differences between these areas, in terms of fertility, fire, and local climate. Fire, for example, occurs much less in California, Chile, and the Mediterranean basin than in South Africa and South-West Australia; and differential grazing has had unequal impact on the regions (*ibid.*). Broodbank has also pointed out that the configuration of Mediterranean insularity finds no close parallels in terms of size and distances involved (2000: 38), and Cherry has also recently claimed that 'the Mediterranean has peculiarities of its own' (2004: 238). The development of human occupation in the Mediterranean-type ecozones is also different, and, although tempting, the idea of human/historical 'convergence' among these ecosystems has been strongly rejected (Blondel and Aronson 1999: 85, 89).

Another important distinction has to do with the fact that, whereas in the other Mediterranean-type areas the bimodal climate is found only along coastal areas (generally along the western coasts), in the Mediterranean it is all-pervasive, covering an area of ca. 10M sq km (Bolle 2003: 8) (it also includes southern Portugal and the Canary islands) (Blondel and Aronson

1999: 17). Water availability is clearly an important factor for human settlement, and it varies greatly within such an extensive region. Goossens (1985) identified five principal rainfall regimes in the Mediterranean basin:

1. NW Spain, N Portugal, N Italy, E part of Mediterranean France: rain evenly distributed over the year (>700 mm/yr);
2. NE Spain, S Spain, S Portugal, W part of Mediterranean France: mainly winter rain; summer: ca. 50 mm;
3. Balearic Islands, C Italy, Greece, parts of former Yugoslavia: mainly winter rain; summer: 80 mm in the north, 20 mm in the south;
4. SE Italy, Croatia, Serbia, Albania: winter rain, summers almost rainless (ca. 150 mm). The E Adriatic is the area of highest annual precipitation (coast >1000 mm; hinterland >4500 mm);
5. Other (mainly southern Mediterranean) regions, e.g. North Africa: <100 mm/yr.

There are some extreme local-scale exceptions to this classification. For example, the region of Bizerte in northern Tunisia has one of the highest rainfalls for that country (Hollis 1999: 606). This is partly because of its setting, since the area benefits from surrounding mountains, nearby oueds (rivers) and freshwater lakes (Hollis 1999: 609).

According to Bolle, most of the water necessary for vegetation is provided by evaporation (either from the sea itself or other water basins) (2003: 34). Water can be transported inland by coastal sea-land circulation systems, which are typical in summer, or by entering the troposphere and then falling as rain (*ibid.*). This suggests that, even during the driest months, some water is supplied to the Mediterranean regions.

Bolle also points out that while temperature is regulated by processes acting on long time-scales, precipitation can vary on much shorter time-scales (2003: 12). Rainfall regimes are particularly hard to estimate because they are related to water run-off and 'evapotranspiration' (i.e. water loss through evaporation and plant transpiration) (Sokolov and Chapman 1974). In the present, the Dalmatian islands have an annual precipitation of ca. 1500 mm/year, whereas, as we have seen, precipitation in the southern Mediterranean generally averages 100-400 mm/year, with four to seven dry months (Lindh 1992: 71). Along the Italian west coast, there are usually two or three dry months per year, while along the Croatian coast there are only one or two dry months per year (*ibid.*). Thornes noted, however, that 'paradoxically, less rain means more intensive rain' (2001: 262), i.e. in general, droughts are followed by heavy rainfall (*ibid.*).

Thornes (2001) remarked on the very high annual variability in rainfall regimes and its consequences. If heavy rain falls in spring, when the soils are either tilled or covered by vegetation, the risk of flooding is minimised. If however the rain falls on bare soils or soil baked by the sun, e.g. at the end of summer, it can have catastrophic consequences, causing run-off and erosion (Thornes 2001: 270). Vegetation cover is thus an important control over erosion, as are well-kept terraces (Blondel and Aronson 1999: 222). If hillside terraces are abandoned, water run-off strips off the topsoil and triggers gully formation (e.g. on Naxos) (Grove and Rackham 2001: 265). Gullies can also be caused by tectonic action (in which case they are known as 'badlands'), so that even densely forested zones (e.g. Rhodes) are prone to erosion (Grove and Rackham 2001: 284). In general however, the most eroded areas in Europe are those where rainfall intensity is highest and vegetation cover lowest: these are the Iberian, Italian, and Greek peninsulas (Thornes 2001: 275). Although several areas are badly affected, according to Thornes, 'the view of desertification or of an erosional crisis is a myth' (2001: 276). This point is also supported by Grove and Rackham (2001: 16, 327), who note that Mediterranean vegetation is 'resilient' and that most processes which could potentially lead to desertification can be reversed in a few years if and when such processes come to a halt (2001: 60).

MEDITERRANEAN PALAEOENVIRONMENT

According to Blondel and Aronson, the bio-diversity of the Mediterranean ecosystem is related to a great extent to 'the succession of cold and warm events' (1999: 27, 89). This diversity is due to the fact that during the coldest phases of the glacial periods boreal animal and plant species migrated to the southern Mediterranean, where they survived side by side with Mediterranean species in '*refugia*' or 'conservatories' (*ibid.*). Certain mountain slopes, large peninsulas, islands, and river valleys were typical '*refugia*' for forests and their fauna (Blondel and Aronson 1999: 27, 59). Thus, during glacial times, the Mediterranean environment was a combination of Mediterranean and boreal species, with many islands populated by large sea bird colonies which are now found in the northern hemisphere (Blondel and Aronson 1999: 29). As the climate improved, the forests and related boreal biota moved north again, but some species remained within the Mediterranean area (*ibid.*). This migration may have lasted into the Neolithic and after, i.e. more than five thousand years after it had begun (Grove and Rackham 2001: 159). According to Grove and Rackham (2001: 157), most areas for which a pollen record exists had oak or pine around 7000 cal. BC. However, the presence of tree pollen does not mean that the whole area was actually forested, and it is clear that forest and steppe alternated (Grove and Rackham 2001: 159).

What is also clear is the fact that several plant and animal species that effectively had been isolated within the 'conservatories' began to differentiate (Blondel and Aronson 1999: 59). This process of differentiation is responsible for the high degree of 'endemism' (i.e. the occurrence of species only in a particular area) found in Mediterranean islands and upland regions (*ibid.*) (Fig. 2.6).

Mediterranean Endemism

The degree of endemism in the flora varies between islands and mainlands and islands themselves: it reaches 11% in Corsica (vs. 7.2% in mainland France), 11.7% in Crete, 9.7% in Sicily, and 12% in each of the Balearics (Blondel and Aronson 1999: 60). The islands also display high levels of faunal endemism, with animals developing peculiar characteristics linked to the lack of natural predators (e.g. dwarf elephants and hippos, and giant rodents). These characteristics may have made such species highly vulnerable to humans (Grove and Rackham 2001: 163) and to climatic fluctuations (Blondel and Aronson 1999: 45).

There are also differences in endemism between the islands in the western and in the eastern Mediterranean, with the exception of endemic birds, which are spread equally (Blondel and Aronson 1999: 77, 80). The most marked differences are in the mammalian fauna, with 23 of the 106 endemic mammal species in the East having an Asian origin. North Africa has 84 endemic mammal species, the Aegean 80, and western Mediterranean Europe ca. 75 (72 for Italy, and 77 for Spain). Differences in the non-flying species can also be noted on either side of the Strait of Gibraltar N-S divide (*ibid.*). Other forms of apparent endemism are in fact the effect of 'feralisation' as domestic animals escaped human control: e.g. the Corsico-Sardinian mouflon and the Cretan goat, which are the present-day wild descendants of the Neolithic domestic sheep and goat respectively (Vigne 1988; Blondel and Aronson 1999: 237).

According to Vigne, humans were responsible for the extinction through killing of the larger endemic species, while smaller animals (e.g. amphibians, reptiles, and birds) survived, with *Prolagus sardus* surviving in Corsica and Sardinia until historical times (ca. 1700 AD) (Vigne 1996: 66; Vigne and Alcover 1985). This extinction was explained by the fact that several modern species were introduced at about that time, in effect becoming predators on the islands' original fauna. He claimed that the very high immigration rates for modern species to the islands (for Corsica, more than 20 species in 8,000 years) could only be the result of human introductions (Vigne 1996: 65). Thus, in the mid 1990s, Vigne argued that these introductions began a little earlier in the eastern Mediterranean (6th mill. cal. BC) than in the west (5th mill. cal. BC), only to increase considerably during the Middle and Late Neolithic (*ibid.*). Recent excavations in Cyprus have pushed these dates back, indicating that domestic species were introduced to that island as early as the 9th millennium cal. BC (Vigne *et al.* 2000: 96; Peltenburg *et al.* 2001: 46) (see Chapter 4).

The issue of whether Mediterranean Pleistocene fauna were extinguished as the result of human action is highly controversial. Cyprus is thought to offer evidence for the coexistence of island endemic species (pigmy elephant and hippo) and human beings (at the site of Akrotiri-*Aetokremnos*) (Simmons 1999: 43, 324). However, Binford (2000: 771) has strongly challenged this hypothesis (see Chapter 4). Similar claims for the Balearics (Waldren 1982) have also been recently discounted by Ramis *et al.* (2002: 8-9), who believe that the bone deposits of *Myotragus balearicus* (an endemic antelope) found in the Mallorcan caves were the result of natural and not anthropogenic accumulation (see Chapter 4).

While the extinction of the islands' megafauna cannot be linked indisputably to human presence, the introduction of modern species is certainly a strong indicator that humans were there. Vigne states that humans introduced species to the islands not just for domestication but also for hunting: fallow deer (*Cervus dama*) was introduced to Cyprus as early as the 8th millennium cal. BC (Davis 1984; Guilaine *et al.* 1995, 1996); fox (*Vulpes vulpes*) to Cyprus and Corsica from the start of the Neolithic; and red deer (*Cervus elaphus*) to Sardinia before the end of the Neolithic (Fonzo 1987), while the arrival of small mammals was probably a by-product of increased maritime contact (Vigne 1996: 67-69).

Vigne also makes the interesting point that wild mammals introduced to the islands are a better indicator of the 'prehistoric compartmentalisation of the Mediterranean' than the domestic species, which were more or less ubiquitous in the Mediterranean (1996: 69). He notes that between the 8th and the 2nd millennium cal. BC, no eastern wild species were brought to the Tyrrhenian islands, nor were any animals from the Italian area introduced to the Balearics; he also claims that differences in composition between Sardinia and Corsican fauna (specifically in the rodents) may indicate two separate colonisation horizons (*ibid.*). This possibility is reinforced by the fact that human genetic data indicate different colonisation histories as well as minimal amount of gene flow between the two islands, although gene sharing during the early stages of colonisation may have been swamped by the islands' complex subsequent colonisation histories (Francalacci *et al.* 2003: 270).

This overview of the Mediterranean palaeoenvironment will now be geographically situated within the context of changing sea levels, which is the subject of the next section.

MEDITERRANEAN COASTAL PALAEOGEOGRAPHY

Increasingly detailed palaeogeographical maps for the Mediterranean have become available over the past fifteen years. Previously, these maps varied considerably because they were based on different sea-level rise curves. A major breakthrough was the production of a reliable global sea-level change curve by Fairbanks (1989) (Fig. 2.7). This curve, subsequently refined by Lambeck (1996), was hailed as 'the most important contribution to glacial sea levels of the past decade' (van Andel 1990: 152). Cherry referred to the Fairbanks curve in his 1990 update of Mediterranean island colonisation data (1990: 192).

Fairbanks (1989) anchored his global curve to radiocarbon-dated samples obtained from submerged coral reefs in Barbados. His study set the maximum depth of the global shore during the last glacial maximum (ca. 17,000 BP) at -120 m. He also demonstrated that sea levels rose slowly to -25m (ca. 8,000 BP, or ca. 7,000 cal. BC), and then to -7m (ca. 5,000 BP, or ca. 3,600 cal. BC). Subsequent changes in shore position were much smaller compared to those during the preceding millennia (Shackleton *et al.* 1984: 309), although local variations may have had considerable effects (Broodbank 1999a: 24). Fairbanks' figures confirmed those used by van Andel (1989), who also adopted -120 m for the glacial maximum, and -35 m for 9,000 BP (= ca. 8,000 cal. BC), and previous ones used by Shackleton *et al.* (1984) and van Andel and Shackleton (1982). The latter adopted these values partly for convenience, since a 36 m isobath was present on many maps and the average horizontal error or coastal displacement was tolerable because the shore at that depth is very steep (van Andel and Shackleton 1982: 448). In some regions, however, where the sea bed is flat (e.g. in the northern Adriatic and off Tunisia), moving the depth of a shore by a few metres may result in a horizontal shift of several kilometres (*ibid.*).

Although the Fairbanks curve was a major breakthrough, van Andel noted that 'people do not live by reference to such an abstract concept as global sea level. Human settlements relate to local sea-levels' (1989: 734). This meant that the Fairbanks curve had to be integrated with local environmental, geological, and archaeological data, in order to be applied locally (van Andel and Shackleton 1982: 447; Gomez and Pease 1992: 2; Lambeck 1996: 590). In the 1990s, Lambeck's work on tectonic movements and the deformation of the earth's crust brought some clarity to this issue. Previous discrepancies between the results produced by different techniques (summarised by Shackleton 1975: 169-182) could be explained by the deformation of the earth's crust, which is caused by the weight of large volumes of water on the ocean floor (a process called 'isostasy') (Lambeck 1996: 592, 594). This introduced some fixed point to sea-level studies, by providing a secure picture at two critical moments, the maximum glacial lowering of the sea (ca. 18,000 BP) and the end of the rapid sea-level rise in the post-glacial period (ca. 8-9,000 BP). Shackleton *et al.* (1984: 312) noticed a convenient pattern, in that the palaeogeographic map at 18,000 BP also seemed valid for preceding cold periods, and the 9,000 BP map for preceding warm periods. This was confirmed by Lambeck, who took it to reflect a cyclical pattern in sea-level change on the long time-scale (1996: 598).

For the purposes of understanding human colonisation of islands, however, the neat contrast noted above may prove over-reductive, since it underestimates the importance of changes which occurred between 18,000 and 9,000 BP (Lambeck 1996: 588). Though slow, coastal changes may have been noticeable over just a few generations, and thus within the span of human memory. For example, Lambeck pointed out that at times of rapid sea level rise (especially after 14,000 BP), coastal displacement in low-lying regions may have been in the order of ca. 1 km/year. A more detailed understanding of local sea-level changes at different times is necessary, since Mediterranean topography is constantly changing as a result of the delayed effects of ice melting (which are due to the Earth's viscous properties) (Lambeck 1996: 606).

Lambeck raised the important point that sea level rises are regionally variable and that the 'concept of a uniform global eustatic change' has 'only very limited value' (1996: 589). Regional differences are affected by local tectonic processes, which can be gauged by examining local geological, geomorphological, and archaeological data. However, data are generally insufficient and only general trends can be quantified, with the result that shorelines can be predicted effectively only for areas where tectonic and sedimentary processes are deemed to be minimal (Lambeck 1996: 601). These areas, however, provide important indications that can be used to gauge the contribution of tectonic factors in regions that appear to deviate from the expected rise (Lambeck 1996: 590).

The correct modelling of the Earth's isostasy in relation to its physical parameters (viscosity and elasticity) and of localised tectonic and sedimentary processes is crucial to an effective reconstruction of past shorelines (Gomez and Pease 1992: 2; Lambeck 1996: 595). Palaeogeography is an evolving subject and while some successful attempts have been made at reconstructing regional palaeotopographies (e.g. Gomez and Pease 1992; Lambeck 1996), in reality we are far from having an exhaustive picture of the Mediterranean as a whole. This would allow us to model effectively when islands became insular or the islands' configuration at the time of their initial colonisation.

Four maps, created using Fairbanks' (1989) eustatic curve and with the aid of Geographical Information System (GIS) software, give a tantalising indication of the potential of palaeogeography for understanding island colonisation dynamics. The examples used here show when the major Balearic islands broke up into constituent islands and the gradual 'insularisation' of the Dalmatian islands as part of the flooding of the Adriatic valley system. The same approach could be used to investigate when the small islands off Sicily became separate (some before others), when Sardinia and Corsica detached, and finally when the smaller Tyrrhenian islands became divided from the Italian mainland, first as a whole and then as individual islands. Refined palaeogeographical knowledge has the potential of allowing us to investigate the changing relationship between humans and their environment by addressing specific colonisation questions: e.g. does the dating of human presence in the Adriatic correspond to periods of high/low sea levels in the area? Can differential 'insularisation' explain the variation in the colonisation dates of the Sicilian satellite islands or of the smaller Tyrrhenian islands?

Before moving on to the new maps, the situation at 18,000 and 9,000 BP is summarised both for the western and eastern Mediterranean. These situations warrant attention because, although most islands appear to have been settled after sea levels reached their present configuration, there is evidence of humans visiting islands before 9,000 BP (Chapter 4). Ice melting began ca. 18,000 BP but sea rise became more rapid after 14,000 BP, with islands in the Aegean still separating at about 8500-8,000 BP, only to slow down again ca. 6,000 BP (Lambeck 1996: 606). Lambeck believes that evidence for human frequentation of the islands may have been lost as a result of coastal plains vanishing owing to rising sea levels (e.g. on Melos, where he suggests that the submergence of a coastal plain may be responsible for the lack of settlements at the time of its Late Palaeolithic and Early Neolithic obsidian exploitation) (1996: 610).

WEST MEDITERRANEAN PALAEOGEOGRAPHY

Around 18,000 BP, large plains existed off the coasts, particularly of Tunisia, Italy, southern France, and eastern Spain (van Andel 1989: 737) (Fig. 2.8). The plains off eastern Spain and between the Pyrenees and the Alpes Maritimes in France were respectively 60 km and 80 km wide (*ibid.*). On the other hand, because the North African coast drops sharply between the Strait of Gibraltar and western Tunisia, it was very similar to the present day. The Strait of Gibraltar was reduced to ca. 8 km, but remained open (Shackleton *et al.* 1984: 310). East of Tunisia and north of Libya, however, the coastal plain was up to 200 km wide, and the distance between Tunisia and Sicily was consequently reduced to ca. 60 km with several intervening islets (Shackleton *et al.* 1984: 310).

Small peninsulas protruded from Sicily and incorporated Malta to the south and the Pelagie islands to the south-west (Shackleton *et al.* 1984: 310). Another small peninsula to the north-west incorporated the Egadi islands. The eastern and NE shores of Sicily are also steep and thus hardly changed (*ibid.*). The existence or not at this stage of a narrow land bridge closing the Strait of Messina is unclear (see section on Sicily). In the Tyrrhenian, Corsica and Sardinia formed a single island, only 15 km away from a wide coastal plain off the NW coast of Italy that included the islands of Elba and Pianosa (Shackleton *et al.* 1984: 310; Mussi 2001: 200). The central and southern west coast of Italy falls steeply and was therefore also more or less unchanged by lowered sea levels (*ibid.*).

The Spanish islands, whose distance to the mainland was reduced by the eastern Spain coastal plain, formed two larger islands, one made up of the Balearics (Menorca, Mallorca, Conejera and Cabrera), the other of the Pitiussae islands (Ibiza and Formentera) (Shackleton *et al.* 1984: 310). A new map shows a refined timing for these processes (see below). At a much earlier stage, the Balearics were actually linked to the mainland. This was during the Messenian event (ca. 5.5 million years ago), when, according to Schüle (1993), *Myotragus balearicus* reached the islands by land.

The northern Adriatic was a plain traversed by rivers and marked by hills (the present-day Dalmatian islands) (Bortolami *et al.* 1977). Shackleton *et al.* consider this plain, which has now completely disappeared, to have been one of the richest environments in the whole central northern Mediterranean (1984: 310). Improved maps showing the gradual insularisation of this basin will be discussed below (see 'New Maps' section).

By around 9,000 BP (ca. 8^{th} mill. cal. BC) (Fig. 2.9), the rise of the Mediterranean sea level slowed and according to van Andel the Mediterranean reached its 'current aspect'. The coastal plains were submerged (e.g. the gap between Sicily and North Africa increased to 200 km) and islands separated into constituent parts (for example, the distance between Italy and Corsica increased to 60 km) (van Andel 1989: 737).

The Tyrrhenian Sea

1. Sardinia and Corsica

Bonifay has described the process of insularisation of the Sardinian-Corsican block ca. 21 million years ago and the formation ca. 18,5 million years ago of several smaller volcanic islands in the Tyrrhenian, such as Capraia (1998: 134). The sea between Corsica and the smaller islands off Tuscany is currently over 400 metres deep, therefore at 18,000 BP (–130m) Corsica was clearly separated from these, while the Tuscan archipelago was linked to the Italian mainland (Camps 1988: 21).

Shackleton *et al.* (1984: 313) found it unlikely that the narrow gap separating Corsica and Sardinia from the Italian mainland would pose an obstacle to humans attempting to cross it to reach the islands during Late Palaeolithic and Mesolithic times. Nonetheless, Bonifay has pointed out the dangers involved in the crossing, owing to strong anti-clockwise currents which make crossing the Canal de Corse treacherous (1998: 134). He suggested that, although longer, a more successful route to Corsica would involve a crossing starting south of Elba (rather than via Capraia), since this might have benefited from a north-easterly wind. Returning to the Italian coast would have been even harder, due to currents pushing against the coasts of Corsica (Bonifay 1998: 134). Sardinia and Corsica, currently divided by a strait which is 65m deep, became separated by a seaway 10 km wide at ca. 9,000 BP, when their distance from Italy increased from 15 km to 60 km (Shackleton *et al.* 1984: 311).

2. Sicily

During the Pliocene, Sicily was made up of three structural units (forming two islands), which eventually formed the island's main mountain ranges (Leighton 1999: 12; Piperno 1997: 83; Mussi 2001: 17) (Fig. 2.10). During the Middle Pleistocene, marine terraces, caves, and coastal plains were formed as a result of tectonic uplift and sea-level changes (Leighton 1999: 13). Leighton (*ibid.*) and Shackleton *et al.* (1984) support the view that there may have been a land bridge linking Sicily to Calabria in the area of the Strait of Messina at this time. Shackleton *et al.* believe that this land bridge, currently located at a depth of 90 m below present sea level, was 1 km wide, and that it vanished around 15,000-14,000 years ago (1984: 310). More recently, Mussi (2001) has questioned the existence of the land bridge, explaining that evidence increasingly indicates that the area of the Strait of Messina was never completely above water. She argues that the present shallowness of the Strait is recent, as uplift movements starting in the Pliocene have caused the strait to rise (Mussi 2001: 202). Mussi explains that the lack of endemism displayed by the Sicilian fauna is not reason enough to justify the presence of a bridge (*contra* Bonfiglio and Kotsakis 1987), and that it is likely that several species managed to cross over a 'discontinuous land bridge of reefs' spanning a shorter distance than today (*ibid.*). She also makes the point that, although there are exceptionally strong currents in the

Strait, Calabria was perhaps an even greater obstacle, in view of its rugged and mountainous nature. Calabria was actually an island at the start of the Middle Pleistocene and become connected to the Italian mainland only later on (Mussi 2001: 90).

During the Upper Pleistocene, Sicily expanded considerably to the SW and, at times, was joined to the Maltese islands, until they became definitively separated ca. 12,000 years BP. To the SW, Sicily extended towards Tunisia (Pelagian shelf) but was not linked to North Africa because of the Pantelleria Rift (Leighton 1999: 15). The presence of this rift indicates that the Pelagie islands, to the SW of Sicily, were at times separated from Sicily (even during the Pleistocene) (Leighton 1999: 14).

To the NW of Sicily, between the coast at Trapani and the islands of Favignana and Levanzo (Ègadi Islands) there is an isobath at 33 m, while an isobath at about 100 m separates Favignana and Levanzo from Marettimo (Bisi 1968). Sea levels in this area 10,000 years ago have been estimated at ca. -47 m, thus Levanzo and Favignana formed a hilly promontory off the western coast of Sicily, but Marettimo had already become an island (Antonioli 1997: 147-8) (Fig. 2.11). Two thousand years later, sea levels reached a depth of 15 m, and Levanzo became insular, whereas Favignana remained linked to Sicily via a narrow isthmus (*ibid.*).

At 9,000 BP the coastal plain of eastern Tunisia was considerably reduced, increasing the distance between Sicily and Northern Africa to 200 km: most of the intervening islets were submerged, apart from Pantelleria (Shackleton *et al.* 1984: 312).

The Adriatic and Ionian Seas

The eastern coast of the Italian peninsula has been the subject of detailed study both by geographers and archaeologists, and as a result the palaeocoastlines of the Adriatic are increasingly understood. Although not all areas have been investigated equally, an exhaustive picture is now available for some parts: particularly detailed are the northern Adriatic (especially the area of the Venice lagoon and the Po delta), and the south-western Adriatic (off the coast of Puglia, especially the Gargano and Tavoliere areas, and

Basilicata). Studies on the eastern Adriatic palaeocoastline date back to the 1970s but, when checked against recent advances in eustatic studies, appear to be reliable.

At the last glacial maximum, the northern half of the Adriatic sea floor formed a wide plain crossed by rivers, as well as swamps and bogs (the 'palaeo-Po river system') (Colantoni *et al.* 1979: 44; Pirazzoli 1996: 71). The rivers originated from the glaciers of the Swiss, Austrian, and Dinaric Alps, and from the northern Apennines (Shackleton *et al.* 1984: 311). The coastline ran E-W and was located roughly across the middle of the Adriatic, where Pescara is now located (northern edge of the 'Meso-Adriatic depression') (Pirazzoli 1996: 71). As sea levels rose, the shore moved gradually to the north, as can be seen in 17 submarine platforms and fossil beach lines (Colantoni *et al.* 1979). According to Sestini, at the Holocene maximum sea level rise, the coast was between 5 and 20 km inland from the present one, indicating that the sea has lowered again since ca. 6-7,000 BP (or ca. 5800-4900 cal. BC) (1999: 459).

Van Andel and Shackleton report that pollen data indicate that during the period between ca. 22,000 and 15,000 BP the Adriatic region had a steppe vegetation, and that the mean annual temperature was about 6°C below that of the present day and the climate was dry (1982: 451). There is also evidence that large herds of animals (equids and deer) inhabited the plain (*ibid.*), which probably provided 'the largest and most accessible food resource of the region' (Shackleton *et al.* 1984: 312).

Along the eastern side, steep narrow hills (now the Dalmatian islands) fringed the plain (Bortolami *et al.* 1977; Markovic-Marjanovic 1971: 187; Pirazzoli 1996: 71), and are likely to have been used as late Palaeolithic base camp-sites (Shackleton *et al.* 1984). Shackleton *et al.* suggested that, although the hunting camps in the plain have vanished as a result of rising sea-levels, sites could still be found on the hill sides (i.e. on the island slopes) (1984: 312).

The plain narrowed along the Albanian coast (van Andel and Shackleton 1982: 450; Shackleton *et al.* 1984: 311), and further south was interrupted by a mountainous zone. On the other side of the mountains, another plain extended from Corfu (also known as Kerkyra) along the NW coast of the Peloponnese to the Gulf of Korinth (van Andel and Shackleton 1982: fig. 2; van Andel 1989: 737). Throughout the Pleistocene, Kephallonia, Zakynthos and Ithaka formed a single island ("greater Kephallonia") about 15 km off the west coast of Greece, while Corfu and the Paxoi islands and Lefkada were joined to the mainland (van Andel 1989: 737; Souyoudzoglou-Haywood 1999) (Fig. 2.12).

The Italian side of the southern Adriatic also had a coastal plain facing east (Shackleton *et al.* 1984: 311). One can still gauge the extents of this coastal plain, now partially submerged, by looking at the present-day Tavoliere plain. The Tavoliere covers an area of about 4,500 sq km. It is surrounded by the mountainous Gargano peninsula to the north, by a limestone plateau (the Murge) to the south, by the Apennine mountains to the west, and by the Adriatic to the east. Along the coast there are lakes (Lago Salso and Lago Salpi, around the Gulf of Manfredonia) and coastal marshes, and two more lakes to the north of the Gargano (Lago Lesina and Lago Varano) (Sargent 1983: 223). The lakes and marshes are what remains of ancient lagoons, some of which opened to the sea and could be navigated (Delano Smith 1987: 14). Delano Smith has argued that the Neolithic landscape of the Tavoliere probably lies not far below the Roman one, and that continuity in the geological record suggests that the Neolithic coastlands looked like those of Daunian times (1st mill. BC), with open lagoons rather than the recent marshlands (1987: 17). The lagoons and islets would have made coastal navigation easy in this area (Delano Smith 1987: 15). By 9,000 BP the coastal plain was submerged (van Andel and Shackleton 1982: 451). The Late Neolithic in this area saw a 'deep environmental crisis' caused by climatic change (low rates of precipitation and high temperatures) (Caldara *et al.* 2002: 127). Because of this intense aridity, the whole coastal area became a semi-desert, as the coastal lagoons, cut off from the sea, became *sabkhas* (salt pans) (Boenzi *et al.* 2001).

EAST MEDITERRANEAN PALAEOGEOGRAPHY

Once again, van Andel and Shackleton's overview (1982: 450-451) provides a good starting point. They maintain that between 20,000 and 15,000 BP many of the present-day eastern Mediterranean islands would have been accessible either over land-bridges or by crossing narrow straits (e.g. Euboea, which was joined to the central Greek mainland). The exception to this is Cyprus, which was only slightly closer to the mainland than it is now, but lost parts of its coastland owing to the rise of sea levels during the Early Holocene (Held 1992; Gomez and Pease 1992: 4; Peltenburg *et al.* 2001: 59, 2002: 76). Late Palaeolithic Greece had several extensive coastal plains (e.g. between Attica and the SE Argolid), with lakes, hills (now islands), and a Cycladic 'semi-peninsula' (*ibid.*).

Van Andel and Shackleton (1982: 451) argued that the Cycladic landmass, which they believed may have been separated from the mainland by a very shallow strait 10 km wide, was at times attached to it. More recently, Lambeck (1996) and Broodbank (2000) have demonstrated clearly that this was never the case. Instead, 'Cycladia' divided the Aegean Sea into individual parts: the Aegean Sea to the north, and the 'Mirtoan Sea' and the 'Sea of Crete' to the south and south-west, which were connected by a few narrow channels (Lambeck 1996: 601) (Fig. 2.13).

Sea levels began to rise around 15,000 BP and continued to do so until ca. 9,000 BP. Although levels rose subsequently by another 30 m, according to van Andel and Shackleton (1982: 454), most areas had achieved their present configuration by then, with the exception of several large islands along the coast of Asia Minor which, at 9,000 BP, were still linked to the mainland (van Andel and Shackleton 1982: 445, 450). Gomez and Pease, who reconstructed the palaeogeography of Cyprus, observed that the island's southern coastline at 9,000 BP was between 1.5 and 2.5 km further out than it is now and that the island reached its present configuration by ca. 5,000 BP (1992: 4).

The Cycladic landmass began to split, at first into two (northern and southern parts) and then gradually into individual islands soon after 12,500 BP (Lambeck 1996: 606; Broodbank 1999a: 20). Lambeck (1996: 606) calculated that sea-level rise during Late Neolithic and Bronze Age times took place at a rate of about 0.7-1.0 mm per year (or ca. 1m/mill.). Although this is slower than during earlier periods (when it reached up to 12 mm per year, or ca. 1.2m/mill.), these figures indicate that during the Early Bronze

Age sea levels were up to 5 m lower than the present (Lambeck 1996: 607). According to Broodbank, Chios, Samos, Kos, Thasos, and Skiathos became islands when sea levels reached a depth of 25 m, followed shortly after by Lesbos, Spetses and Dokos; while Euboia, Tenedos, Salamis, and Poros became insular towards the end of the Neolithic, and perhaps as late as the Bronze Age (1999a: 23, 24).

RECONSTRUCTING SEA LEVELS

Identifying localised changes in sea levels and their effects on the islands' geography at critical phases is crucial to understanding their colonisation. Palaeogeographic maps at 18,000 BP (i.e. the maximum lowering of sea levels) are generally contrasted to those at 9,000 BP, when, according to van Andel and Shackleton (1982) and Shackleton *et al.* (1984), the Mediterranean reached its present configuration and humans began to colonise the islands. Lambeck (1996), however, has pointed out that significant sea level changes occurred both between these periods and after 9,000 BP. Broodbank also noted that several islands probably became insular during the Neolithic (1999a: 24).

By using GIS software, Admiralty charts (which contain detailed sea depths), and the Fairbanks Barbados sea-level curve, new maps can be created showing some of the islands at different sea levels. The examples chosen are the Balearic and Adriatic Islands, as Admiralty charts showing sufficiently detailed depths were available for these at the time of writing. The new maps give an indication of when land bridges disappeared and landmasses became islands, and only an approximation of the islands' shape (as detailed local geological data were not included).

Balearic Palaeogeography

For the Balearic islands, two maps were created in order to determine when this landmass - or these two landmasses - broke up into six constituent islands. The maps show that until ca. 10,000 cal. BC the islands were still joined up into two large landmasses, the first incorporating Mallorca, Menorca, Cabrera, and Conejera, and the second Ibiza and Formentera (Fig.

2.14). By ca. 7,000 cal. BC the first mass split into two individual islands (Mallorca and Menorca) (Fig. 2.15), while the separation of Formentera and Ibiza took place only subsequently, during the Neolithic. The maps also give an indication of how much land was lost as a result of rising sea levels after the last glacial maximum.

Adriatic Island Palaeogeography

Two maps were created showing the Adriatic at two separate phases. Sea levels in the 8th millennium were approximately 20 m below the present shoreline. This means that both the islands of Brač and Hvar were insular at the time when Brač was first colonised (see Chapter 4) (Fig. 2.16). Another map, at -10m, shows the islands ca. 6,000 cal. BC and indicates all the major Adriatic islands as insular (Fig. 2.17).

MARITIME MOVEMENT

So far in this chapter, the Mediterranean has been viewed as an object or a physical entity displaying a complex set of characteristics (its climate, flora, and fauna). It is of course essential to include humans in this discussion, since their presence played a critical role in shaping this environment. This role will be explored gradually in the following chapters, while this section investigates the potential for prehistoric human movement throughout the Mediterranean.

The earliest appearance of deep-hulled sailing ships in the Mediterranean is dated to the 3rd millennium BC (Broodbank 1989: 327-9, 2000: 96). An earlier, possibly Late Neolithic date for the Maltese ship graffiti at Tarxien is still the object of debate (Pace 2004: 73-74). Even with the appearance of sails, however, Mediterranean navigation was slower and more difficult than we perhaps envisage. Early sails were not effective enough to make maximum use of different winds, and could be used to propel the vessel only if the wind was blowing from behind (Giardino 1995: 337). As prehistoric navigation was mainly coastal and the coast is often irregular, constant changes in the direction of the vessel were required in relation to prevailing winds (*ibid.*; Castagnino Berlinghieri 2003: 18). Before the sail, navigation relied on canoe-type vessels, of which two main kinds have been identified (once again in the Aegean) from graphic representations. The first one, in use during the Neolithic-Early Bronze Age, was a small dug-out; while from the Early Bronze Age II period, a 'longboat' came into use, which was possibly powered by up to 25 paddlers (Broodbank 2000: 99). The daily range for small canoes has been calculated as 20 km (either a return journey of 10 km each way, or a 20 km journey in one direction). Broodbank has estimated that crossing the whole of the Cyclades on a longboat would have taken a week if conditions were fine all the way, but was more likely to have taken two weeks if conditions were unfavourable, in which case a return trip would have required around a month (2000: 105). These figures indicate that most islands (in the Aegean but also elsewhere in the Mediterranean) were in 'colonising range' from each other within a day or two (cf. Broodbank 2000: 103, cf. Fig. 24).

On the basis of present currents, and of the assumption that these are likely to correspond to those in the past, Giardino (1995: 272-276) has identified a number of paths of 'least resistance' that could reflect possible prehistoric seafaring routes (Fig. 2.18). In general, if travelling westward across the Mediterranean, a sailing ship could take a northern route along the European shore and return eastward along a southern route (i.e. the North African coast) (Giardino 1995: 338). Setting off from the Peloponnese, the westward journey across the Mediterranean could be undertaken between May and July using currents flowing up the coasts of Epirus and Albania, crossing the Adriatic towards south-east Italy (Puglia) and towards Sicily (Messina), following the coast around the tip of Italy. The opposite crossing of the Adriatic could be undertaken more easily between July and November (Giardino 1995: 337). From December to May, currents favour the journey from western Sicily to southern Italy, then up to the western coast of central Italy (Campania and Latium). From there, a vessel could reach northern Sardinia and southern Corsica more easily between December and March (but also in May and in October). During the summer months, a journey in the opposite direction would lead from central and south-east Sardinia to the Pontine islands and then to the Campanian coast of Italy (*ibid.*).

Giardino also explains that a number of seasonal currents around the Iberian peninsula make the journey possible any time of the year from Cape

Tortosa to the Ebro delta, on to Cape Nao and then towards the Balearics, from where Sardinia can be reached (1995: 338). From southern Iberia, there are two main eastward routes. The southern route uses currents that flow along the North African coast to Cape Bon (Tunisia) from September to May, from where vessels can head for Syrtis and Cyrenaica (Libya) and then into the eastern Mediterranean, taking advantage of the Ionian and Levantine current circuits. Alternatively, a vessel leaving from Cap Bon could reach either south-west Sicily (and then Italy) or Malta, via Pantelleria and the Sciacca banks. The second route leads from Cape Nao to the Balearic and Pitiussae Islands, into the Hesperian circuit, towards North Africa (Algeria), and uses currents that flow between April and June, in August and between October and November (Giardino 1995: 338).

Trans-Mediterranean voyaging is a feature of later prehistory and it is likely that earlier short-range movements were affected by even greater variability. Castagnino Berlinghieri (2003: 17-26, see Figs. 2.19 and 2.20) has described in detail the dynamics affecting the crossing between Sicily and the Aeolian Islands throughout prehistory, and suggested that, although the short journey could be undertaken throughout the year, the crossing could be treacherous as indicated by the high number of ancient wrecks (2003: 34). Papageorgiou (2004) has identified seven main routes allowing year-round navigation within the Cyclades, and linked these 'sea-lanes' to the early discovery and exploitation of resources on Melos and to the establishment of early sites on a number of other islands (such as Kythnos) (2004: 2-3). She goes on to suggest that these can be used in a predictive way to identify further early sites along these sea routes (e.g. on Ikaria) (Papageorgiou 2004: 3). Overall, navigating through different parts of the Mediterranean was possible at various times of the year, although currents could have effectively 'isolated' certain islands or favoured others that are placed on convenient routes.

CONCLUSIONS

The new maps produced for this chapter offer but a glimpse into the islands' changing morphology. Future directions for this analysis, beyond the scope of this work, could involve assessing whether it is possible to translate lost land into lost sites (e.g. by using site densities and distributions for different periods), and whether there is a statistically meaningful relation between depth of sea around islands and age of remains found on them (or, in other words, if the oldest sites tend to be found on islands that have lost little land to rising sea-levels). If proven, this relation might help locate missing sites more effectively, devising a strategy in combination with the insights gained from an improved understanding of marine currents, winds, and boat technology.

This chapter described the dynamic physical backdrop to the cultural processes that will be addressed in the following chapters. Certain underlying 'Mediterranean' features were highlighted that concur to define the region, such as climate, geology, vegetation, and fauna. The work of geographers and ecologists has demonstrated that these Mediterranean features can be found throughout the region regardless of the scale of analysis, though in varying proportions and combinations. Altitudinal changes appear to be as prominent as longitudinal variations (and sometimes more so), a fact that may have major implications in explaining the human use of lands within the Mediterranean sphere.

The palaeogeography section illustrated how ancient coastlines can be used to study effectively the probability of early human presence on islands, but also demonstrated how whole ecosystems have vanished and islands have 'shrunk' over several millennia. The study of marine currents and winds indicates that several sea routes were practicable by vessels in different parts of the year, and that, although basic, technology made these journeys possible in prehistory. The implications of these features will be addressed fully in the following chapter, where different island colonisation motives and dynamics will be assessed.

CHAPTER 3
THEORIES OF ISLAND COLONISATION

Approaches to Mediterranean Island Colonisation

This chapter is a review of a series of leading past and current approaches to island colonisation. This is not a straightforward task, as it emerges that the term colonisation is used differently by individual researchers. For clarity, the following basic definition used in this thesis can be kept in mind: colonisation is the 'setting up' of people's presence in a geographical area. This definition will be elaborated on further, as this chapter investigates whether this 'setting up' took place in an empty area or one where other people were present (previously present or at the time of the newcomers' arrival), what that setting up involved, what motivated it, what triggered that presence, how long it lasted, what obstacles it encountered, and what its outcomes were (see also Chapter 7).

New data concerning the earliest colonisation of islands have contributed to a better understanding of human interaction with island environments, particularly with regard to the different uses that humans make of islands. These advances are a result of an increase in the data available but also of a growing body of theory, which contributes to the former's increasingly convincing interpretation. This growing knowledge, combined with changes in archaeologists' theoretical orientations in the past twenty years, has also contributed to major changes in relation to the concept of insularity. Different kinds of human activity on islands can now be better qualified than in the past, although the degree to which they can be practically separated varies from case to case. This review aims to clarify what kind of activities different colonisation ventures related to; therefore, where possible, the study will refer to these specifically (e.g. visitation, utilisation, settlement).

This chapter takes as its starting point the work of Cherry, and appraises his contributions to the study of island colonisation. In the second part, a series of colonisation studies, some explicitly concerned with islands and others of a more general nature, are also analysed in the light of their potential contributions to the subject. The ultimate aim of this review is to contribute to formulating an improved theory of island colonisation, which will be presented here and elaborated further in Chapter 5, after the review of the data in Chapter 4.

Cherry's Model of Island Colonisation

Cherry's 1981 paper on Mediterranean island colonisation marked a turning point in island studies. In that article, 'Pattern and Process in the Earliest Colonization of the Mediterranean Islands', he used systematic testing and palaeogeography in order to highlight both the advantages and the limitations of using analogies drawn from the theory of island biogeography, as developed by MacArthur and Wilson (1967). Cherry aimed to establish any regularity within the islands' archaeological record which might explain what had led to their first occupation. At the same time he was also interested in the variability in rates and patterns of colonisation. The paper also outlined his theoretical framework by providing the following definitions relating to colonisation:

- *Utilisation*: this would involve only seasonal visits to an island (Cherry mentioned, as potential reasons for these, summer pasturage, access to valued resources, and fishing expeditions) by humans who were usually based elsewhere (1981: 48).
- *Earliest occupation*: this he defined as the 'time when the island became for one or more groups the principal provider of the subsistence requirements and the focus of its residential pattern throughout the year', with possible seasonal trips away from the island (Cherry 1981: 48). Cherry noted that built structures and groups of burials were possible signs of permanence (as they would indicate long-term commitment to a specific land) (*ibid.*).

Somewhat problematically, Cherry (1981) viewed colonisation both as an overall process and as a phase *in* that process. This emerges further into the article, where 'colonisation' is defined as a series of 'tentative, impermanent, short-distance reciprocal movements' by small groups of individuals (Cherry 1981: 60). Colonisation is thus defined *both* as earliest occupation (or the fulfilment of more or less permanent settlement) (1981:

48) *and* as an activity leading to that occupation (i.e. 'tentative movement') (1981: 60). Recent updates have brought little clarity to this issue, since they are largely based on Cherry's theoretical models and rely on the same data.

Patton, for example, used a distinction already made by Cherry between animal and human colonisation to claim that, in the case of animals, discovery and colonisation (or 'the establishment of a population', in Patton's words) usually coincide, while 'a human community may visit an island periodically without actually colonising it' (Patton 1996: 36, cf. Cherry 1981: 41-2). Here too, colonisation is viewed as the establishment of settlements, with little attention to other activities carried out by humans on islands, even though Cherry himself had noted that the archaeological record reflects a complex 'variety of strategies' (1981: 60).

Cherry (1981: 44) made the point that island colonisation should entail human movement to areas that were actually *insular*. Detailed palaeogeographic maps were not available in 1981, but Cherry was aware of the fact that the maximum lowering of the sea during the Würm glaciation had not exceeded c. 130 m ± some degree of error (Cherry 1981: 44, 1990: 192-4, and 2004: 237 for a recent update, which confirms his original study). This allowed him to recognise islands that could never have been joined to other islands or to the mainland in geologically recent times. After reviewing the various claims for pre-Neolithic human presence on Mediterranean islands, Cherry argued that only the finds from Corfu, Alonissos, and Euboia, and those from Sicily, Levanzo, Corsica, and Elba could be accepted as pre-Neolithic (1981: 44-46). However, as noted by Cherry himself, all of these islands could have been reached via land-bridges, except for Corsica. His conclusion was that, excepting land-bridge islands and close off-shore islands, there was scant evidence for 'the human use or occupation of islands anywhere before the beginning of the Holocene' (Cherry 1981: 41).

Cherry explained this lack of pre-Neolithic occupation by the fact that 'Mediterranean islands would have been generally unsuitable as home bases for hunter-gatherers' (in his view being too small to provide sufficient resources), and suggested that improved climatic conditions, the extinction of mainland mega-fauna, and the inception of farming turned islands into suitable places for permanent settlement, the last by allowing increased production from smaller portions of land (1981: 59). However, this seemed to be true only in the western Mediterranean. For the eastern Mediterranean, Cherry criticised Evans' (1973, 1977) claim that island colonisation was a Neolithic phenomenon, although he acknowledged that future finds might change the picture (1981: 62).

For the eastern Mediterranean, Cherry identified a substantial interval between the inception of farming and what he saw as the earliest permanent occupation of the majority of the islands, which appeared to cluster in the Bronze Age (1981: 62). He explained this time-lag in general terms by the fact that, in his view, islands provided 'fragile environments' compared to the mainland (1981: 59) and so, logically, they would have been colonised as a late phase of the Neolithic wave of advance in Europe (Ammerman and Cavalli Sforza 1973, 1979). He also noted some important 'east-west' differences in the islands' geography (1981: 63), which could account for the fact that the pattern of island colonisation then known appeared to reflect an 'inexorable selective pressure favouring the larger islands' (1981: 59) within an 'adaptive framework' (1981: 60).

Cherry also noticed that whilst in the eastern Mediterranean islands tended to be 'individual cultural entities' up until the late 4th or 3rd millennium, islands in the western Mediterranean displayed 'a remarkable homogeneity of material culture at this time', even if they were physically very far away from each other (1981: 63). Cherry argued that the lack of correspondence between island and mainland 'cultures' in the eastern Mediterranean could be taken as substantiating the idea that the communities involved in the peopling of the islands were small and isolated (1981: 61). This, he argued, was not the case for the western Mediterranean, where island and mainland cultures could be matched more easily.

One of Cherry's main endeavours was to investigate differences between the eastern and western islands systematically, by using biogeographic analysis (MacArthur and Wilson 1967). By plotting the approximate dates of initial settlement of the islands in the eastern and western Mediterranean in relation to island size and distance to the nearest mainland (1981: 50-51 – Figs. 3.1-3.2), he argued that the order in which humans occupied the islands was to some extent simply the reflection of these geographical characteristics, and that ecological differences and 'island hopping' may account for some variability in this pattern (1981: 52). The pattern was particularly evident in the eastern Mediterranean, where he noticed that larger and closer islands (generally larger than 100 sq km and less than 50 km away from the mainland) appeared to have been colonised earlier. He also noted that most of the smaller islands (generally less than 100 sq km), which were not suitable for sustaining large populations, were colonised mainly in the Early Bronze Age, and that during this period area, distance, and ecological richness did not appear to have played a prominent role (*ibid.*). For the western Mediterranean, Cherry additionally noted that the first sites also occurred on very large islands (e.g. Sardinia and Corsica); however, he also noticed a lack of patterning in the spread of colonisation during the Neolithic (which he partly attributed to the lower number of islands in the sample) (Cherry 1981: 58).

Cherry also created a plot of cumulative percentages of the islands in the eastern and western Mediterranean which showed evidence of occupation by a given millennium BC (1981: 62, Fig. 3.3 – note that both of Cherry's reviews used uncalibrated dates). He argued that during the 7th and 6th millennia and after the 3rd, island colonisation in the eastern and western Mediterranean followed a very similar pattern, and that the major differences emerged during the late 6th to 4th millennia, when colonisation increased substantially in the western Mediterranean islands. The pattern for the 2nd and 1st millennia suggested the 'gradual infilling' of smaller islands which, according to Cherry, could not support large enough populations without relying on communities on nearby larger islands, which thus must have been colonised first (1981: 52).

Cherry ultimately explained these differences through the dissimilar configuration of islands in the eastern and western Mediterranean: the average distance of the islands to the nearest mainland is similar (according to Cherry's figures, 67 km in the western Mediterranean and 82 km in the eastern), but the western Mediterranean has the larger total island area. The eastern Mediterranean islands are roughly similar in size, while the western ones are either very large or rather small, ultimately suggesting to Cherry the importance of stepping-stone islands, and of large islands acting as 'mainlands' (1981: 63).

Cherry's conclusions were thus (1981: 58):

1. there was no definite pre-Neolithic settlement on any Mediterranean island, although there was evidence of widespread movement
2. the settlement of most islands was a 'relatively late phenomenon' (mainly a Bronze Age one)
3. the chronological pattern of settlement in the east and west Mediterranean differed and geographical parameters were likely to be responsible for this.

In 1990, in a new article, Cherry synthesised some significant developments that had taken place since 1981, but he did not update his graphs in the light of these new discoveries. This would have had an equal impact to his original review, so as it is, several studies of the Mediterranean (e.g. Vigne 1989; Patton 1996; Grove and Rackham 2001) still refer to the graphs contained in the original 1981 article or at best to the 1990 review, both of which are by now in serious need of updating. The 1990 article was intended as a 'resource document', an 'overview of some of the more significant discoveries and interpretative developments during the past decade' (1990: 148). This was in contrast to the primary objectives of his original paper, which attempted to 'extrapolate regional patterns of colonisation from the data' (Cherry 1981: 48).

The main developments synthesised in the 1990 paper included a few instances of Palaeolithic occupation of true islands; a ninth millennium BP (8^{th} mill. cal BC) human presence on all the larger islands or island groups (except Crete); and human presence on Cyprus 'one to two millennia earlier' than previously believed (at the site of Akrotiri-*Aetokremnos*) (1990: 145). He also noted an increase in the number of smaller islands colonised between the seventh and fourth millennia BP (ca. the 6^{th} and 3^{rd} mill. cal BC), and suggested that colonisation in the Aegean may have begun slightly earlier than had previously been supposed (1990: 164).

Cherry had become increasingly concerned with the need to provide a strong empirical basis for the patterns: 'more and better data, in other words, both from excavations and surveys' (Cherry 1990: 202). The realisation that some of the patterns he had observed in the early 1980s (such as viewing island colonisation as a Bronze Age phenomenon) had not stood the test of time may have prompted Cherry to think of different and more effective ways of modelling island colonisation. Thus, in the 1990 paper, he moved towards predictive modelling. He reviewed a series of studies, including Keegan and Diamond (1987) and Held (1989a; 1989b), which explained the likelihood of an island being colonised and the potential of various colonisation staging points based on an island's 'geometric properties' (Cherry 1990: 199). Cherry believed that 'this approach could provide an insight, albeit still theoretical, into the likely geographical origins of the island's colonists' (1990: 201).

Drawing on the significant advances in the palaeogeography of the Mediterranean islands, he argued in favour of a more sophisticated approach to concepts such as 'area' (which should include considerations of habitat variation on islands), 'distance' (which must include the stepping-stone effect), and 'configuration' (intended in terms of target area and the calculation of target/distance ratios to infer likelihood of discovery/colonisation). He concluded that the 'truth would not simply emerge with more and better data' and that it was 'more profitable to get on with the job of trying to make sense of what we know now' (1990: 203). This statement may appear to contradict his previous declaration (1990: 202). However, both express two equally valid points: the constant need to update the models with new and better data from island surveys and excavations, but also the need to ensure that an appropriate interpretative framework is in place, as data themselves cannot provide an answer. Recently, Cherry has concluded that the issue as to 'what we mean by "colonization", as distinct from discovery, exploration, occupation, establishment, [and] utilization' is still unresolved (2004: 239). Indeed, the evidence that will be reviewed in the following chapter indicates that there may be problems arising from viewing only permanent settlement as 'colonisation', while we should perhaps be thinking in terms of a colonisation 'category', made up of different types (and/or phases) of colonisation activities that are related to different aims.

Recent Advances

Advances in ideas about island colonisation in the past ten years have come disguised in different kinds of publications: some have an explicitly theoretical agenda (e.g. Patton 1996) and some a practical remit (e.g. Gaffney *et al.* 1997), while others, these being the most useful of all, offer a combination of both (e.g. Bass 1998; Broodbank 2000). Recent years have seen an increase in island-based projects, which have produced new data that either complement or radically alter views regarding island cultural development. In some cases, these views are broadly confirmed (e.g. Malta and Crete); elsewhere they are changing incrementally (e.g. the Aegean islands). Major advances have concerned particularly Cyprus and the Balearics, with opposite effects on their chronologies; and new regional syntheses have been published (e.g. the central Adriatic islands, Bass 1998; and the Cyclades, Broodbank 1999a, 2000) (see Chapter 4).

These new regional analyses offer a stimulating range of questions and explanations for island colonisation, and their applicability to regions other than the ones for which they were originally conceived can be considered. Broodbank's study of the Aegean islands, for example, and of the Cyclades in particular, poses an important set of questions, which are relevant to any study of island colonisation (1999a: 35-37, 2000):

1. How real are the data-derived patterns currently seen?
2. What coherent or differing factors determined colonisation in each island region?
3. How interconnected were the colonisation sequences in different islands or island groups within individual regions or in the Mediterranean in general?
4. What are the implications of the considerable variations in the colonisation dates attested on different islands?

These questions will be addressed in detail in Chapter 5, but some general points can already be made. As mentioned in the introduction, Cherry noted that 'patterns in human island colonisation displayed a great deal of *noise*' (1990: 199, emphasis added). By this he meant 'anomalies, or colonisation events not following general models', which he attributed mainly to gaps in our knowledge (*ibid.*). These general models drew strongly on other disciplines, such as animal ecology and biogeography, which sought to explain why and how species occupy and thrive on certain islands, and offered island archaeologists some ready-made frameworks. Applying the same framework to human dispersal, however, has proved more problematic. The step from nature to culture has in some cases been too short, and the application of the laws of biogeography to the study of human culture is a likely culprit for the anomalies or 'noise' noticed by Cherry. This 'noise' has stood the test of time, even though new data have been acquired in the past 25 years since it was first noticed (Cherry 2004: 240), and despite the fact that biogeographical approaches have become increasingly refined, through the introduction of more sophisticated spatial variables. This ultimately suggests that current colonisation models require further adaptation and that the data should be considered in a different light. The following discussion is thus aimed at preparing the way for a new theoretical and methodological framework for studying island colonisation (Chapter 5).

'Colonisation' Revisited

One obvious place to start improving the way colonisation has been studied is to investigate the different meanings that researchers have ascribed to it. As mentioned, Cherry viewed colonisation as a series of tentative human movements, but ultimately defined 'successful colonisation' as the establishment of permanent settlement, usually, though not exclusively, resulting from precursor activities such as utilisation (Cherry 1981: 48; 1990: 198). Vigne (1989), Cherry (1990) and Vigne and Desse-Berset (1995) were concerned with defining accurately different types of archaeological evidence diagnostic of these activities: exotic materials were taken as evidence for either visitation or utilisation; other indicators of temporary activities included waste from tool manufacturing and from food preparation and consumption (e.g. wild animal or plant remains). Finally, only structural remains, such as the remains of huts and burials, were taken as evidence for permanent establishment.

In a different context, Van Dommelen discussed the useful contrast between the Roman *colonia* (which involved a broadly replicated and standardised format and has informed the modern use of the terms 'colonisation' and 'colonialism') and the Greek *apoikia* (which simply means 'away from home') (2001: 121). With obvious differences, this general distinction can be applied usefully to islands, where cultures are often considered as 'transported' or 'transformed' landscapes (Gosden and Head 1994: 114): the distinction lies in the fact that people may have initially transported a way of life to the islands that replicated life on the mainland and gradually adapted their ways to new conditions. Evidently, different colonising processes (each with their interests, limitations, and outcomes) will leave different archaeological markers.

Though concerned with historical colonisation, Porter (1994: 12) has claimed that it is important to establish which processes were prominent in the creation of different types of colonies. These priorities may be environmental (e.g. Neolithic expansion; emigration in modern times); economic (e.g. Phoenician, Roman, Greek expansion; modern imperialism and emigration); political (e.g. Greek, Roman, Phoenician; modern colonialism; Fascism); cultural, religious, and symbolic (e.g. Spanish Conquest and Inquisition; medieval Islamic expansion; Jewish diaspora). Stein has recently argued, in the context of 4th millennium BC Uruk expansion (Turkey), that colonisation activities must be substantiated through a complete range of material remains, both architectural and artefactual (e.g. ceramics, raw materials, lithics, and faunal remains), as opposed to just one category of material, and that their spatial patterning is important (Stein 2001: 51-55).

Defining neat categories of material remains corresponding to different colonies/activities (and thus getting to the 'priorities' mentioned above) for prehistory is a bigger challenge. Lyons and Papadopoulos made a similar point to Porter's (1994) in their preface to a series of papers on colonial experiences from the 4th millennium BC to the 19th century AD (Lyons and Papadopoulos 2001: 1). They also argued that, although different, these colonial experiences share a number of common underlying factors, such as issues of 'definition' and 'interplay', as well as 'issues of establishment', but not necessarily 'hegemony' (2001: 11-12). In this respect, initial colonisation is unlike later colonialism, as the colonisation of empty spaces is different from the colonisation of areas where people are already living, since the latter causes 'asymmetrical socioeconomic relationships' to emerge between coloniser and colonised groups (Van Dommelen 1997: 306).

Recently, Rockman (2003) has made explicit the distinction between colonisation of empty spaces and of spaces with a resident population. She notes that, in the first case, the main obstacle encountered by the colonisers is the acquisition of knowledge about the new environment, whereas in the second instance, incoming colonisers have to deal with knowledge, population, and social barriers (Rockman 2003: 17). However, in both cases, overcoming these obstacles depends in part on the primary resource needs of the newcomers. Rockman explains that subsistence systems based on large wild animals, which have large ranges of adaptation, are relatively transferable; those based on plants are less transferable, as plants are impacted more heavily by small variations in climate and topography; and finally those based on non-organic resources, such as the acquisition of lithic materials, are the hardest to transfer, as location affects their geological qualities, so that existing knowledge systems may have to be heavily modified in order to adjust to newly found material properties (Rockman 2003: 19). All of these processes involve the acquisition of new knowledge, which may be more or less visible in the archaeological record.

Difficulties in matching materials and activities emerge from the potential overlap between archaeological correlates. Clusters of burials, for instance, are usually taken as diagnostic of settlement and therefore as a correlate for 'colonisation' (Cherry 1981: 48). However, Nelson has pointed out that, through repeated visitation (e.g. for burial), people develop attachment to places that were either never settled or were subsequently abandoned (2000: 58). The 'utilisation' phase is hard to identify, as it is likely to leave ephemeral traces in the archaeological record. Cherry suggested that one way of overcoming this problem would be to search for evidence (e.g. mineral resources) that can be traced back to the islands (1981: 48). Tykot pointed out that obsidian is a very useful indicator for contact in the Neolithic, since the obsidian found in the Mediterranean comes from island sources: Lipari, Palmarola, Pantelleria, and Sardinia supplied the central and western Mediterranean, and Melos, and to a lesser extent Giali, the eastern Mediterranean (Tykot 1996: 42).

Clearly, there are obvious problems in assessing visitation based on just one category of material, and for other periods establishing human presence on islands can be made difficult by the lack of markers. Evidence for visitation thus remains in the realm of controversial claims, with the result that anything that cannot be securely ascribed to actual occupation is amassed in the 'visitation' category, with very little benefit to understanding this activity correctly. While a phase of visitation/utilisation is now documented (or perhaps expected/inferred) on most Mediterranean larger islands (except Crete, where human presence may have been established on a permanent basis from the very start [Broodbank and Strasser 1991]), it is likely that this evidence relates to a variety of different activities. These 'visitation activities' have received little systematic attention, and have been pigeonholed as being preliminary to colonisation, rather than as constituting a phase with its own set of aims, and thus as requiring explanation in its own right.

The concern with understanding cultural processes and identifying different phases of cultural development is not new in archaeology and anthropology. Schwartz (1970: 178) identified, on the basis of cross-cultural analysis, three phases in the development of a community: a 'pioneering' phase, a 'consolidation' phase, and a 'stabilisation' phase. In the first two to four years following migration (pioneering phase), solidarity prevails, since physical survival is the main issue. For the same reason, there can be a possible loss or decline of some non-utilitarian crafts (1970: 183). Schwartz observed that, during this critical initial time, one or two small groups or families are likely to either leave the settlement and go back or to migrate to another area (1970: 180). In the case of agricultural communities, Schwartz noticed that more permanent structures were built after the first or second good harvest. At this time, social institutions developed and were formalised, and factions tended to arise ('consolidation' phase). Finally, in the 'stabilisation' phase, the 'effects of the migration passed and the community settled down to develop along lines not directly related to the move' (*ibid.*).

Schwartz also noted that the degree of economic and technological change following migration is related to the differences between the original and the new physical environments. When people move within the same environment they tend to maintain their traditional economy, while if they move into a new environment, there tend to be technological and economic changes (1970: 182 – though note that this was not initially the case for Cyprus's aceramic colonisers, see Chapter 4). Overall, migration produced changes in three main areas: 1. social stratification (initially towards equalisation), 2. traditional social units, 3. authority patterns (*ibid.*). Schwartz's observations of contemporary communities should not be taken to apply in all cases, but they do provide an idea of how a migrant community may develop once it settles in a new area.

Guerrero (2001: 139) has recently made even stronger claims for prehistory, stating that 'all colonization involves a series of prior steps', which include 'discovery and exploration, frequent visits, stable settlement or colonization and intensive human settlement'. He also says that 'these episodes, stages or phases are regularly to be found in *every* colonizing process, and *never* in any other order' (Guerrero 2001: 140, emphasis added). Recently, Ramis *et al.* (2002: 19) have rejected Guerrero's model for the colonisation of the Balearic Islands (2000, 2001), as they argue that the early evidence could be arbitrarily assigned to any 'preliminary' phase. In addition, it is difficult to link phases to one another and to colonisation (or stable settlement), since the episodes that 'represent' them are often separated by several millennia, and therefore could be unrelated (*ibid.*). Cyprus illustrates this well, as initial human occupation of the island (the Aetokremnos phase) apparently did not result in intensification and permanent settlement but in abandonment; similarly, the following pre-Khirokitian and Khirokitian phases, which may represent a long phase of adaptation to the island environment followed by establishment, again possibly ended in abandonment (Peltenburg *et al.* 2003; see Chapters 4 and 7).

The material evidence, as we will see in the next chapter, stands in contrast to a teleological approach to colonisation: not all visitation episodes culminated in permanent settlement (e.g. Cyprus and Melos), and not all settlements were preceded by utilisation (Crete perhaps being the most extreme example). This point cannot be stressed too much: islands that lack settlement may have been an integral part of a network (for example a trading network) without necessarily ever being permanently settled (e.g. Palmarola, Melos, Palagruza). By its very nature, abandonment has prerequisite phases, though their character and order of succession are context-specific and should be investigated in that light.

The evidence from the islet of Vivara in the Gulf of Naples also demonstrates the shortcomings of views such as those held by Guerrero (2001). The island has no specific biogeographic appeal (it is small and has no resources), which may account for its being colonised later than its neighbours. However, once settled (ca. 1600-1500 cal BC), it very quickly became an integral part of a much wider network, which included the coastal and inland sites of Campania, the Aeolian islands, and the Aegean (Cazzella and Damiani 1991). Its integration within this system was immediate, with no apparent visitation phase preceding the stage when it flourished as a trading post, a stage that lasted only as long as the transmarine trade that supported it. Vivara clearly represents colonisation in a Bronze Age context (different factors would have been at play in Mesolithic or Neolithic colonisation). Nonetheless, it should not be considered as being exclusive to or typical of a whole period (i.e. a 'Bronze Age' colony) but rather as embodying a certain type of 'activity' (i.e. a 'trading' colony), which could exist (disguised in a variety of forms) in any period when trade was a priority for the founding of colonies.

Phoenician and Greek expansions offer a good contrast between different kinds of colonisation and their potential overlap (with the proviso that they both involve colonisation of areas with existing settlement networks). Moscati argued that, until the military expansion of Carthage, all Phoenician colonies were trading centres, whereas some Greek colonies were founded for commerce and others as residential settlements (1988: 27). Culican, who also made an interesting contrast between Phoenician and

Greek colonisation, stressed the fact that, though different, Phoenician colonies would also have sought 'space, food and freedom' (1991: 485). Graham provided two basic criteria for distinguishing whether a colony was founded for trade: this is either evidence for pre-colonisation trade and/or evidence that the colony lived on trade from the very beginning (1982: 158). However, the distinction is not always so clear-cut. Establishing the level of cultural interaction is also relevant, in terms of assessing the level of human commitment to a territory.

Moscati considered Greek colonisation to be 'pristine', as its main concern was 'land' (i.e. settlement and farming), which was considered a prerequisite for the development of the first urban settlements (1968: 101, 1988: 49; *contra* Osborne 1997: 268). Phoenician colonies, on the other hand, were mere 'factories', mainly involved in trade activities, entailing little interaction with the local populations - except for exchange purposes - and therefore no cultural assimilation (Frankenstein 1979: 284, 288; Whittaker 1974: 75). Moscati, however, also pointed out that Phoenicians in the west settled into enclaves and acquired elements of the local cultures (1988: 80). This was clearly a reciprocal process, as attested by the increased level of socio-cultural complexity acquired by local communities in Southern Iberia, while the Phoenicians were there (between the 8th and 6th c. BC) (Aubet 1993: 278), and by the emergence of urban settlements in Sardinia, which Moscati also linked to Phoenician presence and navigation (1968: 206; for Sardinia, see also Van Dommelen 2001: 137). In a paper entitled 'Greeks in Iberia: Colonialism without Colonization', Domínguez (2001: 70) makes the interesting point that similar processes of differentiation were also set in motion in the following 6th-5th centuries BC, through cultural mechanisms, even though there were no actual Greek settlements in the region (2001: 68-70). Aubet ultimately believes that Phoenician expansion was prompted by a variety of reasons (territorial, agricultural, colonial, commercial, demographic, and military) and that these are evident in the colonies themselves, with their differing political, strategic, and territorial emphases: e.g. Carthage (political), Motya and Gadir (mercantile), and Sulcis (strategic, control of agricultural hinterland) (1993: 75, 186).

The examples discussed so far are intended to make two points clear. First, each 'colonisation' experience is made up of different components or phases. The nature of these phases is specific to the priorities which led to the act of colonising in the first place. This becomes clear if we think that the type of exploration that leads to trading is different from that leading to settlement, as each seeks different aims (e.g. access to trading routes and presence of trading partners vs. land and basic resources). The second point has to do with 'colonies' themselves. The term 'colony' is highly misleading, as it has the connotations of a well-planned venture and of a degree of permanence (cf. Roman *coloniae*). Colonisation (which is literally the founding of colonies) has equal implications. The first time that Mediterranean prehistory gets close to this type of 'colonisation' is with Neolithic settlement. But to say that the 'colonisation' or the Neolithic settlement of Mediterranean islands took place during the Neolithic clearly adds nothing to our understanding of colonisation: it is merely going in circles. The issue to be addressed is how human activity on islands varies through time and space. Neolithic colonisation is therefore but one example of how it can vary.

If, on the other hand, 'colonisation' is viewed as a collection of activities, then different sites can be better understood: visitation colonies, for example, may be more short-lived than settlement colonies, while trading colonies will have different characteristics from colonies defined by clusters of burials, and so on. Studying colonisation by type of activity has the advantage that its development can be explored through time (e.g. by comparing Neolithic visitation colonies with Bronze Age visitation colonies). It also opens the way to different sets of questions: e.g. does visitation in one period (e.g. the Neolithic) count as settlement in others (e.g. the Mesolithic)? The establishment (or demise) of these activities/sites/'colonies' will go through a series of stages, or not in some cases (cf. Crete and Vivara), but their order, as already mentioned, is case-specific. This means that there are no 'typical' colonisation trajectories, although there may be parallels in the development of sites related to similar activities.

These points will be explored further in Chapter 5, after the review of the archaeological data in the next chapter, by examining a number of sites related to different activities. For the moment, this chapter proceeds with the review of theoretical approaches to islands and their colonisation.

Discreteness of Islands

An important advance in island studies, and one that has had great implications for the analysis of colonisation, has been made in the way that archaeologists view islands. During the 1960s and 1970s, the general tendency was to consider islands as discrete entities displaying special characteristics: 'an island is a dry-land of less than continental size surrounded and isolated from other dry land by water' (Fosberg 1963: 5); and accordingly: 'an island is certainly an intrinsically appealing study object...a visibly discrete object that can be labelled' (MacArthur and Wilson 1967: 3). The development of the 'special' characteristics of the 'island ecosystem' (Fosberg 1963: 5) was explained by Vayda and Rappaport in terms of the 'founder effect' principle, which postulates that a species colonising an island will develop differently from its parent population, because only part of the gene pool is brought to the island (1963: 134). However, while they did display such distinctive characteristics, islands could also be studied in order to understand mainland processes: 'by studying clusters of islands, biologists view a simpler microcosm of the seemingly infinite complexity of continental and oceanic biogeography' (MacArthur and Wilson 1967: 3). This approach echoed the work of early 20th century French geographers (e.g. Brunhes 1920 and Vidal de la Blache 1926), who believed it possible to study the Mediterranean environment by focusing on the islands. Biogeographical approaches also influenced the development of the 'laboratory' analogy, which treated islands as closed microcosms, and attained a following in studies of the Mediterranean and Pacific islands alike (Evans 1973: 519, 1977: 13; Keegan and Diamond 1987: 50).

Biogeography has developed over the years, to include concepts such as the 'rescue effect' (Brown and Kodric Brown 1977; Keegan and Diamond

1987), which postulates that island populations close to other sources of population are less likely to go extinct; and the 'commuter effect' (Keegan and Diamond 1987: 59), which indicates that islands that are not self-sufficient can support populations if they are within 'commuting' distance of another source. According to biogeographical theory, the effects of these variables can be gauged through geographical and mathematical formulae. MacArthur and Wilson (1967) originally devised formulae to calculate the potential roles of island area, distance, and presence of intervening stepping-stone islands (Fig. 3.4). Using variables such as island area and 'longest single voyage' (LSV) (Patton 1996: 40), biogeographers calculate an island's 'Biogeographic Ranking' (BGR), which gives an indication of the likelihood that an island will be colonised and that, once there, a colonising population will survive (a high value indicates a high probability):

BGR = island size (sq km)/LSV (km)

Held also devised a target/distance ratio (T/D ratio) (1989a: 13), which takes into account island target size (measured in degrees) on the horizon, rather than actual island size, and relates to the likelihood of an island being discovered (the higher the value the higher this potential).

T/D = target width (in degrees)/ distance from staging point (km)

Because of their geographical configuration, Mediterranean islands cannot be considered as being physically closed entities. This realisation has made the labelling of islands 'natural cultural laboratories' (Evans 1973) increasingly unfashionable, both in this setting and also elsewhere (Rainbird 1999, 2004). A theoretical transition from viewing islands as segregated units to seeing them as interconnected entities may be taking place, as demonstrated by Fitzpatrick's recent edited volume on island archaeology (2004). In his contribution to that publication, Anderson has warned of the dangers of exchanging one extreme (isolation) for another (interaction) (2004: 255). Thus, each insular situation should be judged individually, in order to ascertain an island's changing degree of isolation/interaction over time. Perpillou (1966: 18) defined islands 'as little regions held in a matrix', and more recently King and Kolodny have defined them as being 'semi-closed systems' (2001: 238), emphasising that between the two extremes lies a whole spectrum of possibilities. The critical issue is not so much whether islands constitute individual units in the eyes of researchers, but rather what prehistoric people made of island environments.

Because of its sheer size, Broodbank (1999a: 21) proposed that Crete's first settlers might not have realised they were on an island. Nonetheless, regardless of the fact that in some cases prehistoric settlers may have been unaware of the insular status of their new bases, archaeologists have overemphasised insularity, with the result that islands are often still regarded as closed units, because they are surrounded by sea (cf. Waldren 2002). Guerrero (2001: 136), for instance, viewed the human colonisation of the Balearic islands as 'radically different from the occupation of new territories on the mainland'. He compared the Balearics to 'oceanic' islands, opposing them to other Mediterranean islands in view of their 'isolation'. This argument was then used to support the idea that the Balearics had been colonised later than other Mediterranean islands of comparable size and had undergone two consecutive phases of colonisation (Guerrero 2001: 141). On closer inspection, it becomes evident that Guerrero's reasoning is arbitrary, since the Balearics are larger and less distant from the nearest mainland than an island such as Lampedusa, which was colonised earlier in the Neolithic and has been described as 'the most isolated island in the Mediterranean' (Camps 1988: 46).

Broodbank and Strasser (1991: 233) also originally supported this argument, stating in an article on the colonisation of Crete that 'an island offers a clearly definable unit in which to conduct the search for antecedent human occupation, combined with a typically distinctive and often impoverished range of island biota – excellent circumstances to compare indigenous and exogenous... An island environment furnishes favourable conditions for a feasibility study of migrant colonization as a mode of agricultural expansion'. These statements echo the words of Evans, who emphasised the 'special' physical conditions of islands, which made them particularly appropriate for the archaeological study of populations: 'island communities may offer a number of significant advantages...essentially from the limitations imposed by this kind of habitat on the various forms of life which may be present' (1973: 517).

Clearly, the shift between the micro and the macro scale of observation in island studies depends on the questions being asked, and, as long as physical 'isolation' is realistically assessed (rather than completely rejected or embraced), focusing on individual units of study can be advantageous if carried out within a comparative framework. This change in emphasis is partly related to the shifting attitude towards the role played by the sea itself (e.g. unifying or segregating), which has also gradually changed. The important question in relation to this is whether distance and isolation are directly proportional, or whether physical isolation/distance can be overcome through human networking.

Broodbank and Strasser claimed, at the start of the 1990s, that 'maritime movement requires a distinct spatial re-location, whose minimum range is conveniently calculated as the distance between landfalls' (1991: 233). Although this is certainly true, 'distinct spatial re-location' is not a prerogative of maritime movement but a feature of any movement across any landscapes (even deserts, once one is familiar with them). By modelling distance and travel, however, this study was part of a general movement towards 'humanising' the sea, and hence a move away from the sea as a barrier or the 'isolated island' paradigm (e.g. Helfrich and Townsley 1963) towards the idea of 'seascapes' or a more 'contextualised' island (Gosden and Pavlides 1994; Lape 2004). This movement was already in progress in fields other than archaeology (e.g. development studies), as expressed by Vernicos some years earlier: 'minor islands, particularly those of the Mediterranean, have been enclosed by a web of human activities extending over a large regional area and beyond it' (1987: 101).

Biogeographical studies of maritime movement rely by necessity on a set of simplifications, such as visibility indices (Patton 1996: 45), target-distance (T/D) ratios (Held 1989a: 13), and longest single voyage (LSV) distance (Patton 1996: 40). Such categories are far removed from any true experience of navigation. For example, the angle formed by an island on the horizon (target-distance ratio) varies not just depending on its distance from any given staging point but also on the actual visibility from that point. In reality, visibility depends not just on distance but also on altitude and vegetation (Levison *et al.* 1973: 21), as well as on weather conditions, which may differ on both a seasonal and a daily basis (Bass 1998: 180). Strasser (2003) has recently pointed out that the application of T/D ratios to Mediterranean islands is misleading in view of their configuration, while Anderson has stressed the importance of not treating maritime travel as a given fact, as 'in the past, relative isolation of islands depended on the fundamental relationship between the sea and boats' (Anderson 2004: 263).

Recent years have seen the development of a more flexible attitude towards insularity that emphasises the need to understand how land and sea are articulated. A useful new paradigm has emerged as a result of this shift, which blends islands, sea, and mainlands into an all-encompassing and ever-changing unit, the 'islandscape' (Broodbank 2000: 21). The islandscape emphasises usefully that the sea does not necessarily isolate islands but rather may provide a connective tissue. The concept is highly evocative and has been received with much favour by archaeologists. Anderson believes that the islandscape is not applicable to areas where islands are truly physically remote, but that it is effective in the Mediterranean (2004: 254). Clearly, islandscapes cannot be applied ubiquitously; nonetheless, it is the element of social and cultural interaction inherent in the concept that makes it appealing and broadly applicable, even to areas that display disparate geographical characteristics.

Island archaeologists are increasingly accepting that geographical isolation could be overcome, that 'insularity was a social construction' (Lull *et al.* 2002: 124), and that, in some cases, configuration simply refutes 'the stereotype of the remote and isolated island' (Moss 2004: 180). At the same time, however, several researchers have expressed concern about the fact that, although isolation should also be understood in terms of 'social' factors, geographical isolation is being downplayed excessively (Cherry 2004: 244; Anderson 2004: 255). This debate has encouraged the creation of a whole new set of colonisation models and of new takes on traditional models (e.g. 'autocatalysis', 'sea-faring nurseries', 'super-attractors', 'reticulate evolution', and even 'evolutionary game theory' applied to islanders) (Broodbank 1999a, 2000; Terrell 2004; Kennett and Clifford 2004), all of which share an underlying concern with establishing the role played by configuration and resources, i.e. how islands (and islanders) are articulated with other physical and cultural entities.

Broodbank also offered an approach to 'model the extent of the islandscapes', by determining navigation ranges from the islands, which depend on technology and environmental conditions varying over time (2000: 260) (cf. Irwin's [1992] 'mutual accessibility matrices'). As islandscapes are created not only through direct knowledge of neighbouring places but also indirect contact and accumulation of knowledge, they are potentially hard to define. Zedeño has pointed out that 'landscapes may not be bounded, but they are finite' (2000: 97), and that their limits correspond to the extent of people's direct and indirect interaction with other people and their lands and resources. Archaeological data are necessary in order to define accurately the range of this interaction (or, in this case, the extent of an islandscape). The risk is that the lack of archaeological data may produce increasingly vague or broad islandscapes to account for local cultural development (for example) if evidence for this is missing. Instead, as humans became established on islands, they 'transformed' the landscape at several levels, ranging from the domestic to the monumental sphere, through the development of tailor-made solutions to both newly-found and imported problems.

To return to the issues posed at the start of this section, it has become increasingly clear that Mediterranean islands can provide units of study, but that these units are not sealed, since at least for smaller islands interaction was vital to community survival, and the sea (and maritime technology) provided the means for that contact. Larger islands, such as Crete and Cyprus, were less reliant on networks as they were large enough and had sufficient resources to maintain a self-sufficient population. This line encourages a more comparative approach, between different scales of enquiry (e.g. individual islands, island regions). As briefly mentioned, an important effect of this shift has been a move towards 'configuration' studies, which, in many respects, represent the 'coming of age' of island biogeography, and will be reviewed in more detail in the course of this chapter. Before we move on to this issue, we need to look at colonisation in more detail.

Migration Models and Potential Triggers for Colonisation

Studies of colonisation are generally concerned either with potential triggers and motivations or with the physicality of migration routes, and only rarely with both (but see Rockman 2003). Colonisation is modelled and presented accordingly, usually either as a wave of advance or as a series of points and arrows (temporal resolution is also critical in this) (Rockman 2003: 9). Zedeño and Stoffle have recently made the point that 'studies of human-land interaction tend to favour the settlement over the pathway' (2003: 59). However, identifying these pathways is also crucial to an understanding of prehistoric interaction. Traditionally, maritime technology has been associated more with colonisation studies concerned with spatial orientation than motivation, vessels being considered to be mere conveyors for humans. Increasingly, however, interest in navigation is reaching beyond a concern with the limitations and potentials posed by technology, winds, and currents, and its implications are being explored more effectively. For example, the fact that several Mediterranean islands were in voyaging range from each other (see Chapter 2) could suggest that their discovery did not necessarily correspond to their settlement. In the Pacific, on the other hand, Anderson has claimed that distances and boat technology made return voyaging uncommon, and thus in general it is likely that discovery coincided with settlement (2003: 173). Increasingly, more emphasis is being placed on how vessels can affect the duration of travel, and thus, by extension, perceptions of distance, interaction, value, and knowledge.

Island colonisation has been studied through the application of a variety of migration models, some of which have been largely confirmed by studies of human genetics in recent years (see below). Because of the lower occurrence of evidence for human presence on islands during the Palaeolithic and Mesolithic, island colonisation has been traditionally viewed as a Neolithic and later phenomenon, and often explained through some variation of the wave of advance model and related to the demic diffusion of Neolithic economies in Mediterranean Europe. These models may be effective in explaining one type of island colonisation (Neolithic settlement), but several other cases require different explanations. The issue as to whether Mediterranean islands were colonised selectively and purposively has also engaged much discussion. Broodbank and Strasser pointed out that 'the immediate causes of an individual colonization episode will relate to a host of localized social and ecological factors...without firmer knowledge of the colonists' origins, attempts to understand motivation through reconstructions of homeland conditions are fruitless' (1991: 238).

Genetic studies have the potential of bringing increasingly fine detail to colonisation histories, but are still an evolving subject. According to Francalacci *et al.*, episodes of human movements and settlement can be traced through the genetic record of living populations (2003: 270). Quintana-Murci *et al.* have noted that, in general terms, genetic homogeneity suggests that living populations in the northern and eastern shores of the Mediterranean may share a 'recent' common origin. On the other hand, the marked differences displayed by the Tunisian sample suggest that there was little north-to-south gene flow, with the Mediterranean acting as a relative geographical barrier especially in the west (2003: 166; cf. Bosch *et al.* 1997). In fact, there are problems with identifying original colonisers because of recent gene flows.

Francalacci *et al.* (2003) recently attempted to decipher the different population origins of three western Mediterranean islands (Sicily, Sardinia, and Corsica) by looking at Y-chromosome binary haplotypes (which can be traced back to a single male ancestor). Their study was able to demonstrate that Corsicans are related to central-northern Italian and French populations, but are also markedly different from Sardinians, which excludes significant gene flow from Sardinia to Corsica. They support this hypothesis with linguistic data, which indicate that the Corsican language is more closely related to Tuscan than to Sardinian dialects (Francalacci *et al.* 2003: 276). According to this study, Sicily was significantly different from all other populations, except, as perhaps one would expect, Calabria in southern Italy (*ibid.*). Corsica and Sicily seem to be closely related to neighbouring continental populations, while Sardinians appear to have developed in marked isolation, though there appear to have been links with the Iberian peninsula (Francalacci *et al.* 2003: 274).

These studies provide but a rapid glimpse into the potential benefits of using human genetic data to reconstruct the processes that led to the original peopling of Mediterranean islands. However, the study of modern genetic markers poses several problems in terms of the correct understanding of the origins of prehistoric settlers, particularly in the case of small islands, which are vulnerable to total population replacements. It is clear that a number of different lines of enquiry should be used in addressing colonisation, but, in the light of current knowledge and of the limited availability of ancient DNA, archaeological data, though incomplete, still provide the most viable approach, as they represent the only currently available direct evidence of such processes.

Sedentism and demographic growth have been invoked to explain the increasing need for space in the Neolithic and the colonisation of marginal space, including the intensified frequentation and settlement of islands. The presence of fewer Palaeolithic and Mesolithic than Neolithic sites on islands has been explained by a number of reasons, ranging from loss of evidence resulting from the submergence of land to the different nature of the evidence itself (seasonal camps as opposed to permanent structures), lower population densities (fewer people leave fewer traces), ignorance or inability to reach the island, and deliberate avoidance. Simmons has pointed out that 'if pre-Neolithic sites exist in the Mediterranean, they probably will be in the form of ephemeral, nonarchitectural, occupation' (1999: 26). As the review of the data in Chapter 4 will demonstrate, Palaeolithic and Mesolithic sites present investigators with serious identification issues, since the evidence relating to them usually consists of surface lithic scatters, and identification and dating are generally based on typological grounds that are often unsupported by radiocarbon dating (with a few important exceptions, such as caves and rock-shelters).

The apparent absence of human activity on the Cycladic islands until the late Neolithic exemplifies some of these issues and requires explanation. This absence is particularly striking in view of the islands' palaeogeography, as originally the Cyclades would have formed a much larger single landmass (see Chapter 2) (van Andel and Shackleton 1982: 452; Lambeck 1996: 607), thus questioning Cherry's argument that islands are 'generally unsuitable' for hunter-gatherers in view of their small size and lack of resources (Cherry 1981: 59). Van Andel and Shackleton (1982: 451) suggested that such a landmass was likely to be visited by Palaeolithic people for the purposes of hunting and fishing, and Broodbank (1999a: 20) also proposed that such movement would have the effect of maintaining communication networks within a highly dynamic coastal environment. The recently confirmed Late Mesolithic site of Maroulas (Kythnos, Cyclades) appears to lend important support to these ideas (Sampson 2002), indicating that Mesolithic people did in fact go to the islands. This realisation is becoming increasingly evident from discoveries also in the Northern Sporadhes, the Ionian islands, and the Dalmatian islands, all of which roughly parallel the Cycladic palaeogeography, in that they once formed more extensive territories (in some cases actual coastal plains) or subsequently became part of coastal plain/island systems (see Chapter 2). However, the general dearth of pre-Neolithic evidence has had the effect that colonisation before the Neolithic has been largely overlooked, and classified as a 'pre-colonisation' utilisation phase rather than as real colonisation.

Evans (1977) was among the first to link island colonisation to the 'Neolithisation' of the whole Mediterranean basin: although his focus was west-Mediterranean (having worked extensively on Malta), also on the basis of his work on Crete, he claimed that 'most Mediterranean islands were first settled at a fairly early stage in the Neolithic' (Evans 1977: 14). He argued that, most likely, the islands would have been reached by populations living on the nearest land, following the 'wave of advance' pattern envisaged by Ammerman and Cavalli-Sforza (1973, 1979). As mentioned, Cherry originally disagreed with Evans's claim for an early Neolithic colonisation. He argued that of 31 islands in the west, only a few islands (2/5) were occupied by the end of the Neolithic, while 2/3 were in use by the end of the Bronze Age (1981: 58). He explained this process as a 'gradual filling' or an 'adaptive process' that could be reflected in the wave of advance model, or Alexander's (1978) 'moving frontier' model, both of which implied several hesitant short-distance movements lacking any definite planning, i.e. a form of dispersal (Cherry 1981: 63). In 1990, he partly retraced his steps, stating that although the general pattern was still the same, more Neolithic sites had indeed become known, particularly in the eastern Mediterranean.

Van Andel and Runnels (1995) reconsidered the wave of advance model for the spread of agriculture (Ammerman and Cavalli-Sforza 1973, 1979), addressing its possible causes and suggesting some changes to some of the principal tenets of the demic diffusion paradigm. Such suggestions are useful when discussing island colonisation in general (and not just during the Neolithic). Van Andel and Runnels used the evidence from the Thessalian plain to argue that arriving farmers preferred to settle on floodplains. Neolithic communities flourished on this plain for a millennium, before moving elsewhere (1995: 481, 495). In this model, movement is related to preference for a certain type of land, rather than to demographic pressure. Areas considered to be appealing to early farmers were few and far away from each other, and people therefore settled these desirable lands before moving on to less advantageous ones. This has the interesting implication that the distinction between islands and mainlands may not have mattered, as long as this type of attractive land was available.

In fact, there are only a few places in southern Europe, apart from Thessaly, that offer substantial floodplains: the Morava-Vardar area in the Balkans and the Tavoliere in south-east Italy (van Andel and Runnels 1995: 497). However, van Andel and Runnels also make the interesting suggestion that 'earlier wandering seafarers' might have located new floodplains (1995: 498), indicating indirectly that island colonisation may have been a by-product of this 'scouting' process, and indeed a necessary feature if exploration was to be sustained. This possibility seems reinforced by the early colonisation horizon of the Adriatic islands (see Chapter 4), which lie between the Italian Tavoliere and Albanian floodplains, and of the Northern Sporadhes, which are strung off the Thessalian plain. The model proposed by van Andel and Runnels (1995) thus relies on the presence of certain physical features in the landscape, i.e. floodplains, whether they be the Thessalian plain, or the Tavoliere in south-east Italy (Delano Smith 1987; Sargent 1983; Skeates 2000). However, the model also has broader relevance because it emphasises the concept of 'preference'. While floodplains may have been selected in the Neolithic for farming, other types of preferences (e.g. in terms of resources available or location itself) may have been promoting human presence on islands during different periods.

Peltenburg *et al.* (2001: 55) argued that both Anthony's (1997) 'leapfrogging' model of prehistoric migration and van Andel and Runnels' (1995) 'jump dispersal' model might provide useful ways to account for the archaeological gaps between presumed homeland and destination of early farmers. However, they rejected both models in the case of Cyprus, since they saw little evidence to support jump dispersal or wave of advance models from the Levantine corridor to Cyprus, neither in the Aetokremnos phase nor in the following Khirokitian phase. Because of Cyprus's distance from the mainland, Peltenburg *et al.* (2001: 55) argued that accurate knowledge of the island and navigational skills would have been necessary to reach it from the mainland; skills that, they argued, the distant farmer colonisers from the Euphrates River valley would lack. For this reason, they disagree with the idea of a colonisation 'leap' and anticipate the existence of coastal sites that are now lost (*ibid.*).

Van Andel and Runnels (1995), however, did not exclude the possibility of intermediate sites and that the 'leaps' might indeed be small, although they did envisage purposive and selective colonisation. Ultimately, their model seems highly relevant to island colonisation in general. In the case of Cyprus, for example, while it may not model the exact dynamics of the 'jump', it does provide a framework in which to ask what factors led to separate colonisation events. Different 'pulls' or 'preferences' (perhaps in terms of the island's attractiveness) would have led first foragers and then farmers to travel to Cyprus. These were likely to be foragers who were already exploiting coastal sites near Cyprus and farmers who had already reached the area.

Submerged coastal strips are likely to hide much useful information for understanding colonisation, though not necessarily in terms of providing precursors to island settlement. By focusing on the coast, Galili *et al.* (2002) identified a series of late 9^{th}-7^{th} millennium BP (8^{th}-6^{th} mill. cal BC) settlements along the Carmel coast of Israel, at a depth of about 8 to 12 m.

The investigators named the sites 'Mediterranean Fishing Villages' (MFV), in view of their mixed 'agro-pastoral-marine' economy and of similarities in their dwellings, storage facilities, and production areas. One of their most interesting features is the development of well technology, which allowed people to settle permanently close to the coastline, in areas apparently unoccupied before the 7^{th} mill. cal BC (Galili *et al.* 2002: 169). These wells are about a thousand years later than those found on Cyprus (Peltenburg *et al.* 2003), and therefore are unlikely to represent an intermediate stage between life on the mainland and life on the islands. These coastal sites thus illustrate that people were able to exploit different types of areas which they selected for a variety of reasons.

According to Galili *et al.* (2002: 168), MFVs represent a new 'economic strategy' developed in response to changes in the environment, specifically rising sea levels, increased population, and intensified land exploitation. The features found at these villages, on coastal locations close to the Near Eastern centres of domestication, and the wells in particular were aimed at increasing the carrying capacity of marginal and previously unoccupied or underutilised areas (Galili *et al.* 2002: 183). In this model, the foundation of MFVs and the development of a mixed economy are compared to other strategies aimed at optimising the use of resources, such as mountain transhumance, although in this case the mixed nature of the subsistence base was such that it enabled permanent occupation of the villages. According to Galili *et al.*, MFVs indicate that 'the option chosen was the sea' (2002: 184), in the sense that marine resources were selected by MFV inhabitants as a buffer against both human- and environment-induced resource depletion. In the case of Cyprus, Peltenburg (2003: 97) has made a similar suggestion, i.e. that loss of territory and resources on the Levantine mainland may have prompted the colonisation of new territories and a move away from the mainland (in this case towards islands), in order to avoid excessive competition over resources.

Galili *et al.* review a number of sites (e.g. Shillourokambos in Cyprus, Cyclops Cave on Gioura, Vela Spilja on Korçula, Franchthi Cave on the Greek mainland, and Uzzo Cave in Sicily) that display similar characteristics to those found at Atlit-Yam, an early MFV on the Levantine coast, and argue for an east-west spread of MFVs (2002: 187-189). They also indicate that it is unclear whether this was the result of a cultural or demic diffusion (Galili *et al.* 2002: 184).

Zilhão also envisaged a modified wave of advance model, involving a punctuated series of events (or 'leapfrogging' colonisation) (cf. Fiedel and Anthony 2003), rather than a continuous and gradual process of demic colonisation (Zilhão 2000: 170-71). He identified two main pulses in the process of Neolithisation of central and western Europe, which spread along two directions (a Danubian and a Mediterranean route), and brought about different degrees of interaction between Mesolithic and Neolithic groups (Zilhão 1993: 51-2; 2000; Fiedel and Anthony 2003: 147, 150). Fiedel and Anthony (2003: 163) have recently pointed out that the Neolithic colonisation of Europe took approximately 2500 years, and that it was not continuous, displaying phases of apparent idleness lasting ca. 500 to 1000 years, during which in-between areas were filled up. They suggest that this pattern indicates a planned venture, with knowledge acquired ahead by scouting agents ("Natty-Bumppo" or "frontiersman" model) (2003: 146).

Tolan-Smith (2003) envisaged a similar punctuated process of colonisation in the context of the colonisation of the British Isles, where he identified three colonisation pulses. The first phase of recolonisation (following a seven-thousand-year occupation gap caused by the extreme glacial conditions from ca. 20,000 BP onwards) began around 12,500 BP. The second pulse (11,000-9,000 BP) saw a period of 'consolidation', with occupation extending into areas previously left empty between settlements and limited expansion outside these core areas (Tolan-Smith 2003: 121). The third phase (9,000-7,000 BP) saw the settlement of the rest of the island and of Ireland (Tolan-Smith 2003: 122). Tolan-Smith explained this pattern by the colonisers' need to learn about the resources and topography of western maritime Britain (the intermediate phase), which may have taken up 2000 years from initial arrival before colonisation could resume (Tolan-Smith 2003: 117).

Whether or not the spread of a Neolithic way of life is directly related to the colonisation of the islands found along the way, some of the dynamics hypothesised for this process are worth exploring further in this context. Zilhão envisaged a 'pioneer colonisation model' to explain both the 'enclave situation' of the earliest Neolithic sites in Portugal and, more generally, the 'punctuated, irregular equilibrium' of the movement of farming along the northern side of the west Mediterranean (2000: 170-71). He also made the important point that, from the point of view of work-load and sustainability, there would have been very little incentive to adopt early cereal agriculture, provided that alternative resources were available. This implied that the two strategies would have co-existed for some time. Zilhão thus believed that, initially, farmers would settle only empty areas, and that, subsequently, their demographic growth would have led to intermarriage between the two groups, with the result that hunter-gatherer communities were eventually incorporated. In the process, areas that were not agriculturally viable were jumped, producing small widely-spread 'colonies' or 'enclaves' (Zilhão 2000: 172).

Economic pressure is not the only reason why pioneering groups may have moved. Zilhão (2000) argued, on the basis of archaeological and ethnohistorical data of the colonisation of the Pacific islands (Kirch 1984; Irwin 1992), that this pioneering was planned, and that people moved from one island to the next before they actually needed to (e.g. owing to resource exhaustion), and concluded that social reasons must have been involved. He believed that, as in the Pacific, this 'pioneer ethic' was behind the rapid spread of a Neolithic way of life along the coasts of the western Mediterranean (2000: 173). Thus, the main incentive for movement in this area (and consequently for the expansion of the Neolithic package) may have been a social need to 'fission' before groups outgrew resources (conditions that may have been all the more pressing in an island setting) (*ibid.*). This solution may have involved site colonisation and abandonment, both as a demographic strategy and in response to resource availability, both of which would ensure long-term sustainable land-use (Nelson 2000: 58).

It seems that the implementation of a variety of strategies was the key to ensuring continuous human presence in 'difficult' environments (i.e. those with limited resources). Relying wholly on farming would be highly detrimental to the development of human life on the islands, particularly on the smaller ones, as it would inevitably expose islanders to the fluctuations of early crop yields. A good example of the potential integration of different subsistence traditions comes from the cave site of Vela Spilja on the Dalmatian island of Korčula. The earliest Neolithic deposits (early impressed wares), radiocarbon-dated to the very end of the 7th mill cal BC, included the bones of tuna, dolphin, and sea-bream (Bass 1998: 46). Another cave site, Pupićina Peć, this one on the mainland, 20 km west of Rjieka on the Croatian coast, has produced evidence of a mixed economy (Miracle 1997). The earliest Neolithic date there (5680-5280 cal BC) is roughly contemporary to the earliest mainland Neolithic at Edera in the Trieste karst (5670-5450 cal BC) (Biagi *et al.* 1993), and the Early Neolithic site of Vižula (southern Istria) (5929-5528 cal BC) (Chapman and Müller 1990). But, unlike Korčula, Miracle pointed out that at Pupićina Peć cave domestic animals seem to be the 'intrusive element in what otherwise is a Mesolithic context' (based on lithics and the absence of pottery) (1997: 57).

These examples offer a brief insight into the potential that a mixed economy would have in ensuring a successful island life, and indirectly hint at the fact that, however faintly visible to us, the foundations of human presence on islands in the Mediterranean were laid down before the Neolithic. Vigne and Desse-Berset indirectly supported this idea, claiming that 'at last, the abilities of the Mesolithic people for adaptation to different kinds of environments can be richly documented by the Mediterranean islands' (1995: 309). A number of researchers have commented on the fact that humans introduced both domesticated and wild species to the Mediterranean islands, before, during, and after the Neolithic (Davis 1984; Vigne 1996: 65-67; Peltenburg *et al.* 2001: 46). This suggests an effective manipulation of the environment and indicates that, ultimately, lack of resources on islands during any period would have been only a relative hindrance to human survival. This is of course only as long as 'rotation' strategies were in place, either in terms of actual human movement or movement of goods, or, as we saw, in terms of a strategy involving a broad spectrum of resources, allowing for their consumption and replenishment.

Cherry interpreted the extreme scarcity of Palaeolithic sites in the Mediterranean islands as being more the result of 'avoidance' than of ignorance or inability to reach the islands (1990: 202). He also found it very striking that human presence in the Mediterranean islands increased dramatically when the islands had become less accessible because of rising sea-levels, and believed that loss of land and resources may have prompted humans to tentatively explore off-shore islands (1990: 194). This implies that, although coastal palaeogeography played a prominent role in the colonisation of islands, ultimately its impact can be appreciated only in conjunction with an understanding of human agency, i.e. why humans were moving to some places but avoiding others. 'Avoidance' and 'preference' imply at least some form of short-term purpose, though long-term purpose in the form of an overarching plan may not have been necessary.

Patton (1996) also argued, along similar lines to Cherry's (1981), that the first islands to be colonised (pre-Holocene colonisation) had high 'biogeographic ranking' (being large and close to the mainland), while islands with lower carrying capacity and biodiversity were colonised as a result of subsequent phases of human development (e.g. during the Neolithic, Secondary Products Revolution, and state-organised commerce) (cf. Cherry 1981: 42). By Patton's own admission (1996: 59), this theory is not without its problems, since biogeographic ranking indicates that there are several Mediterranean islands that, in view of their size and distance, could have been expected to support continued human population before the Neolithic, but did not. The opposite is in fact often true, some very small and relatively far-away islands being colonised very early. Patton suggested that these anomalies could reflect 'a significant element of chance in the process of colonisation' (1996: 59). Ultimately, as we shall see in the following chapter, the phases invoked by Patton (1996: 59-62) are chronologically too broad to offer a strong explanatory framework for island colonisation. This is partly because his spatial focus is pan-Mediterranean (1996: 60) with limited enquiry at the regional level, so that local dynamics are not given sufficient weight. Cherry (1997: 501), who praised Patton's contribution as being the 'first book-length Mediterranean-wide treatment of the subject', also heavily criticised his cyclical socio-geographical model and the book's 'unacceptably high level of errors on virtually every page' (1997: 503). Patton (1996: 62), however, did make the important point that the evidence for island colonisation indicates that this was an irregular rather than smooth process of 'infilling'.

Van Andel and Shackleton put forward an alternative explanation to Cherry's, arguing that 'no automatic assumption that land loss equates with a decline in resources seems warranted' (1982: 454). Although they expected whole subsistence strategies based on coastal plains to vanish with their flooding, they claimed that the evidence from Franchthi Cave (on the Greek mainland) showed the opposite, since occupation of the cave was intensified during this period. They explained this by the improvement of the post-glacial climate, which in turn may have had the effect that people could survive on resources obtained from a much smaller territory than before (1982: 446) (a point also made by Lewthwaite 1985a for Corsica). They also claimed that once the seashore moved closer to the cave (owing to rising sea levels), this added an important marine contribution to the cave-dwellers' diet (van Andel and Shackleton 1982: 452). If we accept that Franchthi cave represents only 'a partial record of human activity in the area' (Lambeck 1996: 610), then the existence of other similar instances becomes likely, and its relevance to islands more evident, since these improved conditions may have ensured human subsistence over more prolonged periods and supported populations more effectively than in the past.

The migration models discussed so far are relevant to Neolithic island colonisation, although some hold broader relevance (because they emphasise useful concepts such as 'preference', 'agency', and 'avoidance'). Some of these colonisation models have overemphasised the idea of a long-term trajectory in island colonisation, usually in the form of some economic or ideological pioneering (van Andel and Runnels 1995; Zilhão 2000; Anderson 2003). Colonisation involved a variety of activities, some purposeful, others serendipitous: demographic growth, sedentism, and a preference for certain types of land are but a few of the reasons that may have prompted the search for new territories. In fact it would be over-reductive to view even Neolithic colonisation as just a response to these factors, since, far from being a monolithic block, it involved a much more complex set of processes.

In Chapter 5 we will see that, while there was a strong take-off in island colonisation during the Neolithic, colonisation should be studied also in relation to what happened before and afterwards. The archaeological data indicate that island colonisation was both geographically and chronologically varied, with different sets of priorities leading to a range of results. Mesolithic, Neolithic, and Bronze Age island colonisation were distinct phenomena, though some underlying factors do exist: Mesolithic and Neolithic colonisation, for example, clearly differ, but they are both effective subsistence strategies developed in response to specific requirements. The former is more concerned with 'mobility, aggregation and place-focused residence and land-use' (Nelson 2000: 53, 58), where 'continued utilization of land would have extended the duration of claims on the best lands' (Adler 1996: 355 in Nelson 2000: 57); while the latter has more to do with sedentism and permanent settlement.

Studies of island colonisation developed in recent years take several of these factors into account. As discussed, the scope of these studies is becoming increasingly all-encompassing, perhaps in reaction to previous ones that treated islands as individual units. The growing tendency to consider islands as being part of broader physical and cultural systems ('islandscapes') is the focus of 'configuration' studies, which combine a geographical and cultural take on island development.

Configuration Studies

The realisation of the importance of configuration and of viewing islands in relation to nearby islands and mainlands, rather than as isolated units, is not that new, but only recently have configuration studies come to the fore. Held (1989a, 1989b) already argued in the 1980s that insular configuration should include distance, presence of stepping-stone islands, palaeocoastlines and morphology, and island size. Broodbank has also claimed that 'regional configuration of mainland coasts and islands, rather than individual islands' configuration, based merely on size and distance, are more relevant for the overall analysis of colonization' (1999a: 19).

Bowdler (1995), who discussed the colonisation of Australia's islands, also argued in favour of a regional approach exploring different island-mainland relations. She noted that the settlement of Australia's islands took place much later than the mainland, as the Pleistocene evidence found on some of the islands dates to when they were not insular. Bowdler explains that, as territories became islands as a result of rising sea levels, resources became insufficient to support populations in isolation from the mainland. A concomitant loss of maritime skills may have contributed to populations dying out on most islands, except for Tasmania and a few others, which were large enough and afforded sufficient resources for community survival (Bowdler 1995: 945). Bowdler links the 'reinvention' of watercraft during the Holocene and the colonisation of offshore islands to a phase of 'intensification' of the prehistoric record on the Australian mainland, which might reflect either social or environmental change (Bowdler 1995: 955). Geographical configuration and processes operating on the mainland had an important effect on the Australian islands that was not restricted to the time of initial colonisation: Bowdler (1995: 945, 947) thus makes a strong case for mainland-island relations being essential to community viability on the smaller islands, and for physical isolation and lack of resources being responsible for abandonment (see Chapter 6).

Renfrew (2004) has very recently emphasised the need to include the mainland and islands 'acting' as mainlands in island studies. He identifies two processes in the formation of networks of interaction and island cultural development: 'archipelago intensification' and 'main island intensification' (Renfrew 2004: 289). The first model sees no single island as dominant, but rather marine interactions between peer polities are important for sustained community development on the islands, and favourable location within the marine network is also seen as critical; the second has a large island or mainland developing 'notable' cultural developments as a result of interactions between communities within the island itself, which may often be in isolation (here interaction is not critical), before these developments spread to other neighbouring islands (Renfrew 2004: 290).

Broodbank's (1999a) study of the Aegean islands is a clear application of configuration analysis to island colonisation. He used configuration to provide three models for the origins and expansion of colonisation in the Aegean. The first examined sea-level changes and investigated the possibility that island settlement involved 'dry-shod entry and subsequent insularization'. In this model 'island life is something that is gradually thrust upon already resident groups' (Broodbank 1999a: 24), i.e. people find themselves on islands owing to rising sea levels. The second used the size/distance index, identifying a small number of 'super attractor' islands, with high area-distance ratios (these are generally large islands close to the mainland) that could prove inviting to early colonists. The third applied the concept of 'seafaring nurseries' and of 'autocatalysis' (a concept explored originally by Keegan and Diamond 1987), in order to identify other viable areas that would provide opportunities for island settlement and further expansion (Figs. 3.5-3.6). In this model there is no single 'super-attractor' island, but colonisation is induced by the cumulative effect exerted by the islands collectively.

Broodbank (1999a: 27) argued that the presence of large coastal islands ('super-attractors'), such as Samos, Kos, and Rhodes, made the south-east Aegean the most favoured area for colonisation in the Aegean. Its overall configuration also rendered it one of two likely 'jump-off zones' into the Cyclades as a whole (the other route being via Attica-Euboia) (Broodbank 2000: 133). Some sixty Late Neolithic and Final Neolithic sites are known in the south-east Aegean (Broodbank 2000: 133), suggesting that Late Neolithic colonisation may have been 'fairly ambitious in its scope' (Broodbank 2000: 135). However, there is no definite evidence for island settlement in the south-east Aegean before the Late Neolithic (Broodbank 1999a: 32). Moving on to the south-west Aegean, although this area lacks a super-attractor, the overall configuration of mainland and islands may have encouraged island colonisation, as part of a 'relatively unconscious' process of expansion in the Final Neolithic and Early Bronze Age (Broodbank 1999a: 33).

As discussed in Chapter 2, several islands in the Aegean became insular either towards the end of the Neolithic or even in the Bronze Age (Lambeck 1996) and are therefore likely to have been colonised as a result of 'dry-shod' human settlement (Broodbank 1999a: 24). Some of the northern Sporadhes were probably colonised in this way (Broodbank 1999a: 22) and also, considering shallow sea levels, the Tyrrhenian (Elba) and Ègadi islands in the western Mediterranean. This does not necessarily make them marginal to a study concerned with island colonisation, since such a distinction would depend on what we view as being most relevant (e.g. insular status). In this respect, Broodbank has raised the thought-provoking question 'Was Kea colonised or the coastal landscape of Kea facing Attica?' (2000: 142). Whether or not territories were islands ('islandness', in a word) was clearly an issue, but not necessarily a primary concern to prehistoric exploration: islands are an obvious natural component of the Mediterranean environment, and the fact that territories were becoming islands might have aided the transmission of cultural elements within this maritime setting, rather than detracting from it.

The potential of configuration can also be explored for other areas in the Mediterranean. The Adriatic islands, for example, have produced Early Neolithic material, and a few Dalmatian islands have yielded possible Upper Palaeolithic and Mesolithic evidence. The Tremiti islands form, together with the islands of Palagruža, Sušac, Korčula, Hvar and Vis, a series of stepping-stones across the Adriatic between the Italian and Croatian mainlands (Fig. 3.7). This configuration is likely to be responsible for the fact that the islands were occupied from an early stage, and quasi-continuously when viewed as a group. There are, however, further elements to consider, particularly a series of similarities in the overall configuration of, on the one hand, the Tavoliere plain and the Tremiti islands (Delano Smith 1987; Jones 1987; Skeates 2000: 170) and, on the other, the Thessalian plain and the northern Sporadhes (van Andel and Runnels 1995).

Both the Thessalian and Tavoliere plains lack evidence for Mesolithic population, but were densely occupied in the Neolithic (van Andel and Runnels 1995: 494). Cherry thought it likely that the settlement of the Northern Sporadhes had begun 'at a relatively early point in the Thessalian Neolithic cultural sequence' (1990: 168), and that the first inhabitants were likely to have come from the Thessalian mainland, making the most of the relative accessibility of this stepping-stone chain of islands (Fig. 3.8). This configuration would justify their colonisation a millennium earlier than other island groups in the Aegean (e.g. the Cyclades). The point was followed up by Broodbank, who viewed the early colonisation in the northern Sporadhes as unsurprising when linked to the development of Early Neolithic settlements in Thessaly, and when combined with the distances and currents involved (1999a: 29).

In view of their configuration, the likelihood of pre-Neolithic visitation of the Tremiti islands is also high. This is particularly clear if we look at island groups whose configuration resembles that of the Tremiti, and where evidence of an earlier human presence exists, i.e. the northern Sporadhes (as mentioned) and the Ionian islands (which were also arranged off a floodplain, see Chapter 2). The data from the Ionian islands suggest their continued use, first as part of a wide coastal plain, and subsequently, after sea levels rose, in the utilisation/settlement of the actual islands. This scenario was envisaged by van Andel and Shackleton (1982: 451), who considered the likely possibility that the coastal plain stretching south of Corfu towards the NW Peloponnese may have been sufficiently productive to support hunting groups all the year round. Even when sea levels rose, some coastal plains remained exposed on Kephallonia, Lefkas, Zakynthos, and Ithaka (Souyoudzoglou-Haywood 1999: 5). These, combined with the short distances involved, may subsequently have attracted incoming farmers. However, the Tremiti Islands have not yielded material predating the Early Neolithic, although there may be some indications of a passing human presence (see below and Chapter 4).

Resources

Island studies have also focused on the role of resources in triggering colonisation. Bass (1998) investigated insular discovery, colonisation, and resource exploitation in the Adriatic during the early Neolithic, using biogeographical analysis (BGR ranking and target/distance ratio). His conclusions were that geometric parameters, such as area and distance, were not decisive elements in the colonisation of Adriatic islands, and that resource availability and location within the archipelago in relation to such resources were more relevant. In particular, good-quality flint (though not as desirable as obsidian), found at a few sources such as the island of Palagruža, would have provided an incentive for early maritime contacts (Bass 1998: 181).

Bass claimed that the Adriatic evidence supports Cherry's (1981) distinction between insular colonisation (i.e. settlement) and utilisation. However, the categories he proposed were explored for three degrees of 'insular utilisation' only in the Neolithic, and not for preceding or subsequent periods (1998: 181). To the first category, he ascribed islands that could sustain only short-term human occupation in view of their extremely limited terrestrial resources (such as Palagruža or Jabuka). The second included islands that could support 'medium-term and possibly multi-seasonal cultural commitments' (Susač and the Tremiti islands). These islands are described by Bass as having limited terrestrial diversity, but at the same time as offering sufficient wild resources to complement the diet and some land for farming and herding, as well as fresh water sources. They are also close to mainland resources and other cultural groups. To the third group, Bass assigned islands that could sustain long-term occupation. Korčula, Hvar, and Brač could maintain a sedentary settlement and a large-enough population (1998: 181). These are the islands which have yielded the earliest material (1998: 178).

On first inspection, Bass's categories appear to rely on Cherry's interpretation of 'earliest occupation', defined as 'the time when the island became for one or more groups the principal provider of the subsistence requirements ... throughout the year' (1981: 48). However, Bass also set out to explore networks of interaction, sidestepping the idea that an island ought to be the 'principal provider' of a community's sustenance. Although Palagruža appears to defy his classification, in that it is a small far-away island with limited food resources that has yielded Early Neolithic material and evidence for subsequent occupation (see Chapter 4), Bass explains that the island's mineral resource and their exchange were responsible for the fact that the island was inhabited, however impermanently (Bass 1998: 167). A dual mineral resource exploitation strategy, involving both the Palagruža and Gargano flint sources, on the opposite shore in Italy, would have contributed to the livelihood of the island (Bass 1998: 181; Di Lernia *et al.* 1992, Galiberti *et al.* 2001).

The Tremiti Islands also have their own source of flint, on the small island of Capraia (Fumo 1980). This source strengthens the possibility of their pre-Neolithic exploration (which, as we saw, is a sound option based on the islands' overall configuration). Fusco (1965: 193, 196) noted that some isolated surface finds on San Domino and the islet of Cretaccio (Tremiti) looked very much like their mainland Upper Palaeolithic 'Gravettian' counterparts from the Gargano, and that pre-Neolithic contact could not be excluded. Jones supported this possibility, in view of a group of sites along the northern coastline of the Gargano, all of which are associated with flint extraction and which he dated to the Upper Palaeolithic (Jones 1987). Jones argued that the existence of these sites along the northern littoral, and the difficulties imposed by over-land travel due to the rugged interior, suggested that flint and chert products were transported by water to the northern and south-eastern sides of the Tavoliere (Jones 1987: 114; also Delano Smith 1987). As briefly mentioned, Bass (1998) referred to these claims to substantiate the existence of a flint exploitation network across the Adriatic during the Neolithic, although the precise dating of these sites and their relevance to previous periods is open to question (Whitehouse pers. comm.).

Skeates (2000: 170) has recently suggested that it is possible that 'the south Adriatic region formed one large but environmentally and culturally unified interaction zone', where 'small human groups belonging to seasonally mobile, boat-using, low-density populations exploited a variety of coastal and maritime resources...maintaining sizeable social networks of kin-based contact and exchange with each other'. Kaiser and Forenbaher (1999: 322), similarly, have argued that Palagruža and its flint source illustrate how people developed 'miniature, attenuated versions of core/periphery systems'. The importance of islands as production, exchange and resource centres cannot be underestimated.

Configuration and resources, however, should not be analysed in a mutually exclusive fashion. Either could be taken as being partly responsible for why an island was visited, although neither is perhaps sufficient in itself to explain why people might decide to settle an island permanently. Kaiser and Forenbaher (1995) interpreted the configuration of the Adriatic as crucial in ensuring human movement, while at the same time the presence of different resources on the islands may have ensured that human presence was continuous, when the region is viewed as a whole. The discovery of metal sources on the island of Vis may explain the continued and intensified use of the Adriatic islands in the Late Archaic, Classical, and Hellenistic periods, when interest in lithic resources declined (as suggested by Colonna 1988: 366; also Kaiser and Forenbaher 1999).

Configuration and resources played a combined role in the colonisation of other island groups. In the case of the Aeolian islands, location within the archipelago in relation to the obsidian sources may have determined which islands were colonised first, while the changing value ascribed to obsidian may partly account for variation in the phases of cultural development in the archipelago. While in the Adriatic metal sources ensured cultural continuity, in the Tyrrhenian Sea, the focus of activity eventually shifted from the Aeolian islands towards the metal sources of Sardinia and Elba.

Conclusions: Towards a Comparative Approach

Camps claimed that 'les îles méditerranéennes ne peuvent être étudiées globalement' (1998: 129). Whilst he was right to say that Mediterranean islands display such a huge variety of differing characteristics that it may seem counterproductive to consider them collectively, a balance must be struck between a study of islands on a global and individual scale. Bass stated that 'all insular settings will have unique aspects that may not correspond with models derived from other areas' (1998: 175). As a result, no island or island colonisation event should ever be taken as representative or paradigmatic. Models are, by definition, simplifications of reality; similarly, viewing islands through a comparative framework relies necessarily on a set of generalisations. As long as these are made explicit from the start, the strength of this approach is undeniable, in that it offers the opportunity to study islands on several scales, starting with the individual island, moving onto island groups and then regions, and also to switch between these scales or to choose at which end to start the analysis. This potential will be exploited fully in the course of Chapter 5, where the analysis of the colonisation data from the islands will form the basis for a new approach to colonisation, initial points of which were laid down here.

Within a comparative approach, there is still scope for treating islands as discrete units of study, though not as geographically or culturally discrete entities. Broodbank singled out a shortcoming of Cherry's analysis of island colonisation: 'Cherry's focus on high-level comparison operates at the expense of context-specific exploration' (Broodbank 2000: 108). The analysis of the colonisation data (in Chapters 4 and 5) aims to re-address this imbalance by bringing back individual islands to the stage of pan-Mediterranean analysis and by identifying island basins where factors of a comparable nature appear to be operating. If certain characteristics of islands can be seen to be promoting their colonisation, then their relative importance can be addressed effectively by contrasting the physical characteristics and the cultural trajectories of individual islands. These islands provide the 'laboratories' to be investigated, and it is in this spirit that the data from the islands will be presented in the next chapter. But this is also where the laboratory analogy ends, as the units compared are not sealed or pristine: on the contrary, the 'corrupting' or connecting action of the Mediterranean sea results in both cultural heterogeneity and homogeneity (Horden and Purcell 2000). If the aim is to identify what coherent or differing factors are promoting colonisation in each island (or island group), these variables will emerge only through comparison between island regions. The resulting observation is that island colonisation has perhaps to do more with relative than with absolute chronology, and with relative size, distance, and resource availability than with absolute thresholds. Archaeologists, on the other hand, have concentrated their strengths in the opposite direction, being more concerned with identifying a single moment or set of circumstances which made island colonisation a more viable strategy, without realising that this might have happened several times in the past.

Recent years have seen an increase in island projects as well as some major theoretical contributions to island archaeology. Biogeography remains fundamental to the subject, but researchers have realised that its full potential can be achieved only when used as part of a combined theoretical framework rather than on its own. The models discussed highlighted the fact that colonisation has been viewed as a long-term trajectory, and often tied to the inception of farming (van Andel and Runnels 1995; Zilhão 2000). The idea of island colonisation as a long-term strategy stems partly from a tendency to emphasise the difficulties inherent in maritime spatial relocation, which has made the 'reaching of islands' the explicit object of much archaeological investigation. The data in the next chapter, however, will indicate that distance was not so severe a hindrance to island colonisation in the Mediterranean, with even remote islands being reached early (e.g. Lampedusa). Despite this, modelling human relocation onto Mediterranean islands has long been an attractive subject and task for island archaeologists (cf. Irwin [1992] for the Pacific islands).

The review of the literature also highlighted changes in archaeologists' attitude towards insularity. Islands still provide 'intrinsically appealing study objects' (MacArthur and Wilson 1967: 3), but there has been a major shift in the way they are studied, as exemplified by the move from islands being considered as isolated units to their forming part of broader cultural networks. This has in turn encouraged the development of new approaches to island colonisation, which were also reviewed in the course of this chapter. Cherry's work received particular attention as it has provided, more or less directly, a basis for much subsequent work on the subject. This development has witnessed the adaptation of approaches typical of the 1970s and 1980s, which have been elaborated, as years of applied biogeography in the Pacific islands have highlighted both its advantages and drawbacks (cf. Rainbird 1999; 2004). As a result, Mediterranean island archaeologists since the 1990s have been able to learn from this tradition and also from their own mistakes and successes (Cherry 1990, 2004; Patton 1996; Bass 1998; Broodbank 1999a, 2000).

Two elements emerged strongly from the review of the studies. The first is an improved awareness of the importance of spatial variables, which has resulted in studies of configuration. The other is the renewed focus on resources, in terms of their availability, location (resource configuration), and changing value, all of which would have varied over time. Primary resources (e.g. edible flora and fauna, water sources, arable land, etc.) were clearly necessary to island life, but some islands were also the sources of desirable secondary resources. The importance of these two variables cannot be underestimated, since they are not exclusive to a single period or area, but, on the contrary, can be explored within different chronological phases and regions. Thus, they offer the opportunity to move away from explanations of colonisation whose scope is restricted to a single chronological period. Rather than imposing further constraints on human movement, configuration and resources emphasise the potential opportunities that islands have to offer. They therefore have the important consequence of bringing human agency (which has been largely ignored by island biogeography) back to the fore, since it is humans, after all, who were moving between islands and who sought and used such resources. The potential for further application of such theoretical developments will be reviewed in Chapter 5.

CHAPTER 4

COLONISATION DATA

This chapter is a presentation, review, and analysis of the colonisation data from all Mediterranean island groups from west to east. The review takes as a starting point the data contained in Cherry's 1981 and 1990 papers, which will be added to and/or amended as required. It critically appraises data that either have become available since Cherry's (1990) update of island colonisation (e.g. the Adriatic islands) or that, although available at the time, were not included in that review (the North African islands), and aims to assess the degree to which our knowledge regarding colonisation has changed in the interim.

The review collates the results of island projects in the Mediterranean islands since the 1930s. As a result, it attempts to systematise different types of colonisation data acquired under different research strategies. Rather than dealing exclusively with permanent occupation (Cherry 1981: 48, 1990: 198), individual sections devoted to island groups or individual islands provide an idea of how human activity (including settlement) varied spatially and temporally across the Mediterranean, and of some of the problems in assessing its degree of permanence. Different research agendas, the uneven degree of archaeological exploration in different areas (see as an example Fig. 4.1), and the loss of evidence from the islands caused by rising sea levels all contribute to rendering the definition of colonisation and abandonment processes problematic. However, this wealth of data will be reviewed here and systematically analysed in the following chapter.

While traditional geographic regional divisions are adopted here in the first instance, the east-west divide has been deliberately omitted. Instead, it is hoped that the review will highlight both physical and cultural similarities and differences between the islands, and that these, when taken collectively, will form the basis for the discussion in the following chapter, where processes acting within and between the islands will be explored and clarified.

It should be noted that not all the sources consulted used calibrated radiocarbon dates. For the sake of clarity and to allow cross-referencing and comparison, I have calibrated all dates that fall within the range of Stuiver and Pearson's calibration curve (1993a, 1993b). Dates are shown in the original uncalibrated form (yrs BP) followed by calibrated date ranges at 2σ confidence levels. In some cases, calibrated dates are quoted as approximations (e.g. mid 7th mill. cal. BC).

SPANISH ISLANDS

The date of the first human occupation of the Spanish islands (Balearics and Pitiussae) is a matter of debate, which, particularly for the Balearic islands, has escalated vehemently in recent years. In 1990, Cherry announced that major progress had taken place in the archaeology of the Balearics since his 1981 article, and that a set of over 200 radiocarbon dates, supposedly reaching back to initial colonisation, had become available. Waldren was one of the principal investigators in those years, and a major player in promoting Balearic prehistory to international attention up to his recent death (through the organisation of several conferences in Mallorca and the publication of their proceedings). Waldren (1992: 4) used the radiocarbon dates to produce a 'pentapartite division of Balearic prehistory' (Tab. 4.1).

At the start of the 1990s, Cherry reviewed the dates that were to form the basis of Waldren's (1992) chronology. He selected the sites for which he could identify reliable evidence, and observed that the earliest known sites were all found in caves and rock shelters in the mountainous north of the island of Mallorca (the northern Jurassic sierras). These included (Cherry 1990: 184-187):

- The So'n Matge rock-shelter: this site produced a stratified sequence that was taken to indicate occupation from the 6th millennium cal. BC, followed by a second phase of occupation in the 5th- 4th millennium cal. BC (Waldren 1982, 1986: 69-84);
- Ca'n Canet: data from this cave site (also known as Cova de Canet) were interpreted as evidence of continuous human presence from at least the

ninth millennium BP (10173/7044 cal. BC at 95% probability) (Kopper 1984);

- So'n Moleta: this site produced 36 radiocarbon dates ranging from 2180 BP (ca. 200 cal. BC) to ca. 45000 BP (Waldren 1982, 1986). Layer 7 (KBN-640d; KBN-640c and UCLA-1704c) was taken as indicating possible co-existence of humans and *Myotragus balearicus* (an antelope type of endemic mammal).

The three sites were taken to support an interpretation of the process of colonisation of the Balearic islands that has been widely accepted until very recently (Alcover *et al.* 1981; Cherry 1990; Patton 1996; Vigne 1999). In particular, the evidence from So'n Matge and So'n Moleta was taken by Waldren (1982) to indicate that Mallorca was inhabited from the first half of the 7th millennium BP uncalibrated (mid 6th millennium cal. BC) and that humans and *Myotragus balearicus* overlapped for some time, suggesting that there might have been attempts to domesticate this species. Other investigators used data from Ca'n Canet as evidence that humans were present on the islands as early as the 8th millennium cal. BC (Lewthwaite 1989; Guerrero 1997; 1999; 2000; Alcover *et al.* 1999; Costa 2000). Cherry (1990: 188) noticed that, if reliable, data from these sites implied that domesticated animals and ceramic technology were introduced to the Spanish islands at least two millennia after the initial colonisation of Mallorca (or ca. 3500 cal. BC), and much later than on other islands (e.g. Corsica, Sardinia, and Sicily).

For the Pitiussae islands, Cherry (1990: 188) listed the following sites for which he saw reliable evidence:

- Formentera: a carbon 14 date on human bone of 3270±80 BP (ca. 1600 cal. BC) from the megalithic chamber tomb at Ca na Costa indicated that the site was occupied by the early second millennium;
- Ibiza: Ca'n Sargent, material possibly later than Ca na Costa;
- Cabrera and Conejera: Punic remains earliest known.

Cherry commented on the fact that, since the islands provide a series of 'stepping-stones' from the mainland (ca. 100 km away), the late dates for the earliest sites in the Pitiussae islands were striking, especially when compared to their much earlier Balearic counterparts (1990: 188). The gap was explained as the result of inadequate exploration, though Cherry also suggested that it could be simply that Mallorca was selected initially as it was the largest island in the archipelago (*ibid.*).

Balearic Islands

An increasing number of radiocarbon dates from different sites have become available in the past decade, not necessarily bringing further clarity to the issue of the first colonisation of the islands (see Fig. 4.2. and Table 4.2). Table 4.2 contains both the 'old' and the 'new' dates, both of which are discussed here. Recent publications reveal some problems with the traditional chronology as proposed by Waldren and accepted by many. Three of these papers provide the main basis for the following discussion: Guerrero (2001) in *Journal of Mediterranean Archaeology*; Ramis and Alcover (2001) in *Proceedings of the Prehistoric Society*; and Ramis *et al.* (2002), also in *Journal of Mediterranean Archaeology*. Unfortunately, the authors did not have access to each other's material. Thus Guerrero (2001) makes no mention of the thoroughly exhaustive review of data published by Ramis and Alcover (2001) (and vice versa); and a small editorial note at the end of the Ramis *et al.* (2002) article informs us that the Guerrero paper was not available to the authors at the time of writing. Not surprisingly then, the papers use the same evidence to expound rather opposing views regarding the earliest colonisation of Mallorca (and by extension of the smaller Balearic islands).

For the sake of clarity, only the main lines of argument are discussed here. These can be summarised as three main positions regarding the earliest colonisation of the Balearic islands: Early or Pre-Neolithic colonisation, pre-6th millennium cal. BC (Lewthwaite 1989; Guerrero 1995, 1997, 1999, 2000); Intermediate or Neolithic colonisation, 6th, 5th or 4th millennium cal. BC (Waldren 1982, 1992; Lull *et al.* 1999, and Guerrero 2001, who changed his mind); and Late or Post-Neolithic Colonisation, 3rd millennium cal. BC (Ramis and Alcover 2001; Ramis *et al.* 2002).

1. **Pre-Neolithic Colonisation**: The identification on typological grounds of unstratified 'Palaeolithic' tools made by Guerrero (1997) at So'n Real (Alcúdia) Lithic Workshop (Mallorca) was ruled out by Hernàndez *et al.* (2000). Lewthwaite (1989: 545) and Guerrero (1995, 1997: 33, 1999: 566, 2000, 2001) argue that the islands were colonised as early as the end of the 8th millennium cal. BC, on the basis of data from Ca'n Canet. The evidence from this site, with dates taken from fine charcoal layers sandwiched between thick accumulations of sterile alluvium, is considered to be of anthropogenic rather than natural origin, with Guerrero arguing that the layers represent deliberate deforestation by humans through the use of fire (Guerrero 2001: 141).

2. **Neolithic Colonisation**: Waldren (1982: 112-4; 1992: 3), who rejected the earlier evidence from Ca'n Canet, argued, considering So'n Moleta and So'n Matge, that humans were present in Mallorca from ca. 5600 cal. BC. Guerrero (2001) subsequently argued, using pollen diagrams taken in Mallorca, that changes in vegetation, particularly oak, do not appear to be significant before ca. 4500 BC, which is also roughly when the endemic fauna became extinct (2001: 145). He used this evidence to argue that it was at this time that human groups on Mallorca started to have a stronger impact on the island's ecosystem. In order to reconcile the gap between the earlier colonisation horizon and this change in ecology (8th/5th millennium cal. BC), Guerrero suggested that the earlier evidence from Ca'n Canet represents only 'sporadic visits' to Mallorca (2001: 141), and that these were followed by a phase of intensification in human presence (or 'establishment') on the island. Guerrero selected a series of dates to fit in with his model of human intensification: these included a date of 4798 cal. BC (KNB-640d) from the Moleta cave (Waldren 1982: 35-72), as well as a date from So'n Gallard of ca. 3972 cal. BC (BM-1994R) (Bowman *et al.* 1990; Waldren 1998: 154-56). Both these dates are highly controversial (as pointed out by Ramis and Alcover 2001; Ramis *et al.* 2002), since they are respectively derived from a mixed sample of human bone and from charcoal in only apparent association with the pottery industry. On the basis of this controversial evidence, Guerrero suggested that the first inhabitants arrived in the island around ca.

4700-3900 cal. BC (2001: 147), and that 'around 3000 BC a stable population may have become established' (2001: 148). He concludes that between 2600 and 2500 BC 'the process of adaptation to the island environment in Mallorca was complete', and that by then settled communities inhabited all the islands (2001: 148). Lull *et al.* (1999: 20) have also claimed (using evidence from So'n Matge) that the earliest human occupation took place around the mid-4th millennium cal. BC, and more recently Lull *et al.* (2002: 123) have proposed a new chronological scheme that places occasional arrivals and occupation ca. 5000 cal. BC (Table 4.3).

3. **Post-Neolithic Colonisation**: Ramis and Alcover (2001) and Ramis *et al.* (2002: 4) object to the evidence used to substantiate both an early and an intermediate colonisation horizon for Mallorca. Together with Ensenyat (1991: 261) and Castro *et al.* (1996: 11), they reject the earlier evidence or accept some of it as representing either 'seasonal occupation' or 'accidental arrivals', which did not result in permanent settlement. Ramis and Alcover (2001) point out that the possibility of a very early colonisation, as early as the 10th millennium cal. BC (based on two radiocarbon dates from Ca'n Canet), had already been discarded by both Waldren (1982) and Cherry (1990), because it had proved impossible to link the dated evidence to a human origin. Ramis and Alcover (2001) also rejected the late 8th millennium cal. BC date from Ca'n Canet because, apart from the unclear stratigraphy at the site, it is derived from wood samples, which are controversial as evidence for human presence. In addition, none of the remains of *Myotragus balearicus* showed butchery marks, and thus their dating could not be related to a contemporary human presence at the site.

Ramis and Alcover (2001) and Ramis *et al.* (2002) also explained some of the problems posed by So'n Matge and Moleta with regard to dating. The early evidence from So'n Matge is discarded for a number of reasons. Firstly, it is rejected because of problems with the dating itself: the dates, which are either taken from carbonate samples or from unidentified charcoal, are so inconsistent that four different stratigraphic interpretations for this site have been offered. In addition, the accumulation of coprolites of *Myotragus balearicus,* taken as evidence of stabling (and by extension of human co-existence and attempted domestication), is more likely to be a natural accumulation (Ramis *et al.* 2002: 8-9), as the bones and horns shaped as 'forks' and the alleged butchering marks are likely to be the result of bone chewing by *Myotragus balearicus* itself (Ramis and Bover 2001).

The 6th and 5th millennium cal. BC dating from So'n Moleta is discarded by Ramis *et al.* (2002: 7) once again because the stratigraphy of the site is unclear, but also because the 2910±120 BP date given to layer 5 (Y-2258), which yielded pretalayotic pottery, was published incorrectly as 3910±120 BP. The authors also mention a new date from this site, taken from a human thoracic vertebra found in a more reliable context in the cave than the mixed human bone remains used by Waldren (4798 cal. BC, KBN-640d). This may be up to 3000 years later (Beta-135404: 2210-1880 cal. BC 95%).

Ultimately, Ramis and Alcover (2001) and Ramis *et al.* (2002) reject all the earlier dates from So'n Moleta and So'n Matge, as well as dates from other sites (So'n Ferrandell Olesa, So'n Gallard, Escorca, Cova de Betlem, Caló des Cans, Cova de Tossa Alta, and Cova Murada) on the same grounds (2002: 11-13): because they are either based on charcoal or collected at levels with questionable associated human elements (Ramis *et al.* 2002: 13). Thus, they reject the lithic evidence from Santanyí (Carbonell *et al.* 1981, Pons-Moyà and Coll 1984, and Waldren *et al.* 1984), which Lewthwaite (1989) and Guerrero (1997, 2000) (contra Lull *et al.* 1999 and Hernàndez *et al.* 2000) had taken as evidence of a human presence prior to the Neolithic, on the basis of poor dating and lack of parallels with mainland pre-Neolithic industries (Ramis *et al.* 2002: 11). They take this lack of pre-Neolithic lithics from Mallorca to invalidate the early colonisation stance, which implies that that the first settlers would have been pre-Neolithic hunter-gatherers. In addition, since no early mainland Neolithic cultural elements, such as cardial pottery, are found at any of these 'early' sites, Ramis *et al.* (2001) support the idea that humans must have arrived in Mallorca not just after the end of the Epipalaeolithic/Mesolithic, but also after early Neolithic industries had disappeared on the mainland. They support their hypothesis through palynological evidence, which seems to indicate changes in the landscape, perhaps linked to human action, only in the third millennium cal. BC, which would also substantially shorten the overlapping between humans and *Myotragus balearicus*. The proposed colonisation dating would also have the benefit of reducing the gap between the original settlers (if the earlier Moleta dates are to be taken seriously) and the Late Neolithic or Copper Ages evidence, i.e. the many sites of the Pretalayotic period (ca. 2700-1400 cal. BC) (Ramis and Alcover 2001).

Ramis *et al.* (2002: 12-13) believe that only Cova des Moro and Coval Simó provide sound evidence of the earliest human presence in the Balearic islands. The evidence from Cova des Moro consists of two dates, one obtained from a human bone (UtC-7878: 2470-2130 cal. BC), the other from the jaw of a non-native (i.e. domesticated or at least introduced by humans) caprine (Beta-155645: 2290-2030 cal. BC). The date from the human bone is adjusted by about a century to take into account the marine component of the diet due to the coastal location of the site: thus a more accurate date is presented as being ca. 2030 cal. BC. The two dates are taken as evidence that there was a human presence in the Cova des Moro between 2030 cal. BC and 2470 cal. BC 2σ.

The result of this rigorous review is that the authors reject all evidence of human presence on Mallorca prior to ca. 2000 cal. BC, thus putting forward the idea of a late human settlement of the island in the 3rd millennium cal. BC. This dating would make Mallorca and minor surrounding islands 'the last territories in the whole Mediterranean to be colonized by humans' (Ramis and Alcover 2001). The dating from Coval Simó, also on a non-native caprine (MNIB 80508; Coll 2001), of which a molar was found in the earliest stratigraphic level of human occupation excavated so far on the site, was 2300-2030 cal. BC 2σ (Beta-154196). This date is used to reinforce the presence of humans on Mallorca only slightly prior to 2030 cal. BC 2σ ($p>95\%$) (Ramis *et al.* 2002: 13).

Establishing what is 'right' or 'wrong' in these three main lines of argument, or which colonisation horizon is more reliable, is not straightforward. Ramis and Alcover (2001) and Ramis *et al.* (2002) have pointed out some serious shortcomings in Balearic prehistory as we knew it until very recently, although some elements may still be salvaged. What emerges strongly from the accounts of the data offered by different scholars is that the available evidence probably pertains to different sets of activities. These would have included settlement, but also initial exploration, repeated visits for resources or other cultural reasons, exploitation, and so on. This diversity may account for some of the temporal discontinuity noted between the sites. Ensenyat (1991: 261) already noted that the archaeological record from Mallorca reflects a discontinuous occupation of the island, and that the Moleta and Matge early evidence may have represented a 'utilisation' stage, in the form of initial visits to the island by a human group, and that 'real colonisation' (by which he intended permanent settlement) of Mallorca took place only during the third millennium BC. Bellard (1995: 443) was also concerned with the gap he noted from the end of the sixth to the third millennium cal. BC, and argued along similar lines. Ramis and Alcover (2001) objected to the fact that the earlier dates represented initial seasonal occupation, and put forward the idea that they embodied an earlier 'accidental unsuccessful arrival'. This is because they felt that humans would rather settle in Mallorca, which offered sufficient resources, than travel periodically to the island across a 120 km stretch of sea. Whatever the case, the difficulties with interpreting the dates correctly have perhaps more to do with the scholars' way of viewing colonisation, than with something inherent in the dates themselves (though ultimately some dates have had to be discarded owing to poor archaeological practice).

The accounts reveal a general unease with accepting the possibility that human presence on islands might have been a punctuated, fragmented, discontinuous process, as opposed to a continuous and linear one. In this respect, there is no reason to assume that the early activities documented at any site (if the dates are indeed to be accepted) had anything to do with the later settlement of the islands. If the two are held to be separate, then the whole notion of a gap disappears, since one would expect other activities (or none at all) to have taken place in between, with different sets of evidence, more or less visible in the archaeological record, reflecting this diversity. Overall, it seems reasonable to accept that permanent settlement of Mallorca took place in the 3rd millennium cal. BC, though this should not preclude the possibility of earlier human activities focusing on the islands. This later horizon seems to be reflected on nearby Menorca. There is no equivalent controversy affecting the dating of the smaller island's initial settlement, as there is no Menorcan counterpart to the early Mallorcan cave sites.

Moving on to Menorca, Guerrero (2001) states that it has proved difficult to demonstrate the presence of settled humans on the island before ca. 1800/1700 cal. BC. Guerrero (2001: 147) mentions that the site of Cova des Tancats (Ciudadela) on Menorca has produced *Myotragus balearicus* bones thought to be in physical association with pottery. However the bone was dated 9380 cal. BC (KIK-398/UtC-3740), whereas the charcoal associated with the pottery revealed a date of 630 BC (Mestrès and Nicolas 1997). Using new evidence from two dolmen-like monuments known as Biniai Nou-1 and Biniai Nou-2 (Gómez 2000, Plantalamor and Marquès 2001, van Strydonck and Maes 2001), Guerrero claims, however, that some people had settled on Menorca in the second half of the third millennium BC, after what may have been a previous phase of frequentation around the end of the 4th millennium cal. BC (2001: 147). The earliest date on individuals exhumed from this cemetery falls around 2200 BC (UtC-8949; UtC-8950), which according to Guerrero (2001) provides the only secure *terminus ante quem* for the permanent long-term colonisation of the island.

Ramis *et al.* (2002) agree that the earliest date from Biniai Nou, UtC-8949 (2290-2030 cal. BC, 2σ), on human bone, at present constitutes the earliest solid proof of the presence of humans on Menorca. The date was further adjusted to allow for the marine component in the diet (Van Strydonck and Maes 2001) to 1930 cal. BC. Another approximation to the true age of the sample was calculated by Barrett *et al.* (2000), who provided a date of 2200-1970 cal. BC (2σ). Ramis *et al.* (2002: 14) suggest that the sample shows that humans were on Menorca before about 1930 cal. BC.

Pitiussae Islands

The initial colonisation of Ibiza and Formentera is generally placed around 2000 cal. BC (Bellard 1995: 447; Costa and Guerrero 2002: 489). This dating fares well with that of Menorca and more recent determinations for Mallorca (see previous section), and indeed this colonisation horizon seems strengthened by clear cultural parallels between the Pitiussae islands and the Pretalayotic culture on Mallorca at this time (Bellard 1995). These include similarities identified both in the settlement and in the mortuary sphere (boat-shaped habitation structures or 'navetas' and megalithic tombs), as well as in everyday life (in the pottery and, partly, the metal finds) (Bellard 1995: 448). These parallels have prompted the hypothesis that the initial inhabitants of these islands originally came from Mallorca (Chapman 1990: 263-4). Bellard (1995: 448-449) also notes that human presence (documented in open-air habitation sites, caves, and megalithic tombs) does not seem to continue after 1300-1200 BC.

Guerrero has recently pointed out that, in view of their position, the earliest human evidence should be found on these islands, rather than on Mallorca or Menorca (2001: 145), and that the lack of Neolithic inhabitants in Ibiza and Formentera may represent a gap in the data rather than actual archaeological reality (2001: 148, 2002: 495). He thus expects future research to rectify this situation. Guerrero (2001: 145) mentions two 6th- and mid-5th millennium cal. BC dates from the site of Es Pouàs in Ibiza, taken from apparently charred bones of endemic bird species (Alcover *et al.* 1994), as evidence for a human presence on the island at that time. Bellard (1995: 449) also mentioned the same dates as possible evidence of a human presence on Ibiza in the 5th millennium cal. BC. Ramis *et al.* (2002: 14), however, have since rejected the 5th millennium cal. BC dates from Es Pouàs, and Costa and Guerrero have also some reservations over this date, both because a direct link between the burnt bird bones and human activity cannot be demonstrated and because the materials found in the layers where some contemporary activity can be demonstrated have different chronologies (2002: 488). Ramis *et al.* in fact took the dated bird sample as an indication that humans were not then present on the islands, or that their presence was only very recent (2002: 16). This is because they associate the arrival of humans with a rapid process of extinction of all endemic bird species or at the very least with substantial changes in the structure of bird communities (Alcover *et al.* 1999).

Guerrero (2001) also mentions a cattle bone from the settlement of Puig de Ses Torretes in Ibiza, dated around 2100 cal. BC (UtC-8319: 2140-

1880 cal. BC, 2σ) (Costa and Benito 2000). This date is supported by Ramis *et al.* (2002: 14), who take it as being the earliest evidence for human presence in Ibiza, at some point prior to 1880 cal. BC (95%) without a clear *terminus post quem*. However, they add that human presence cannot be proved on Ibiza prior to 2140 cal. BC (95%).

In the 1990s, the late colonisation of the Pitiussae islands stood out when compared to what was reputedly the Neolithic colonisation of nearby Mallorca, and prompted further thought. Bellard explained it in terms of the islands' lack of large mammals (no remains of *Myotragus balearicus* have ever been found in the Pitiussae) (Alcover *et al.* 1994), and few water sources, all factors that may have rendered the islands less attractive for settlement than nearby Mallorca (1995: 449). However, in the light of the recent review of Balearic prehistory, Bellard's (1995) concerns are less alarming, since the alleged gap between Balearic and Pitiussic settlement may have been substantially reduced. If the early dates from Mallorca (Moleta) and Ibiza (Es Pouàs) are rejected, the colonisation horizons in the third millennium cal. BC of the two islands conform. However, if more reliable 'earlier' dates do emerge, they would begin to substantiate the idea of an earlier human presence on both islands (perhaps a pre-colonisation phase, though the two phases are not necessarily related). If the earlier dating from Es Pouàs could be safely linked to some form of human activity, we would be faced with another gap in the archaeological record of the Spanish islands, which, in the case of Ibiza, would last from about 5000 to around 2000 cal. BC. Considering the previous discussion, it is hard to accept the 5th millennium cal. BC date from Ibiza as evidence for initial settlement.

If more reliable earlier dates turn up in the future, we should concentrate our efforts on understanding what the evidence and dates indicate in terms of the activities or phases they represent (phases which may or may not be directly linked to each other), and only subsequently attempt to fit them into the larger picture. This idea seems to be supported by the archaeological record of the islands, which reveals how human occupation of the islands was discontinuous even after their settlement (this will be investigated further in Chapter 7), and suggests that the islands' long-term history may have been made up of several perhaps unrelated periods of human presence. Bellard's (1995) paper informs us that a systematic survey of Formentera in the late 1980s, while revealing thirty new prehistoric sites, also confirmed the total lack of human presence from the late second and early first millennia BC. Bellard also observed, on the basis of an archaeological map of Ibiza also prepared in the late 1980s, that the island seems to have been practically deserted between 1300 and 650 BC, when it was re-occupied by the Phoenicians, who also occupied Formentera in the fourth century BC (Bellard 1995: 451, 453; Gonzàlez and Díes 1992: 348-53).

Alboran

The island of Alboran is in the so-called Mar de Alboran, which is the name given to the far western side of the Mediterranean (Fig. 4.3). The island and its rocky neighbour, Las Nubes, an islet separated from Alboran by the Canal de las Morenas, would seem to provide ideal stepping stones between Spain and North Africa. At the maximum lowering of sea-levels, emerging islets would have subdivided the sea into smaller stretches; however, crossing the Mar de Alboran is treacherous because of strong dominant winds and currents (Sautkin *et al.* in press; Nick Barton pers. comm. 2004). There is no evidence of human presence on the island in prehistory.

SARDINIA

The past three decades have seen great progress in our understanding of Sardinian prehistory, both through the use of absolute dating methods (radiocarbon dating and obsidian hydration) and in response to an increase in momentum in archaeological research (Fig. 4.4). Tykot (1994) mentioned that only 47 archaeological sites were known in 1963, and that all but one were considered to be Copper Age sites (Lilliu 1963: 28-29). In contrast, at least 12 Early Neolithic sites, 15 Middle Neolithic, and 125 Late Neolithic sites were known by the mid 1990s (Tykot 1994: 115).

In 1990, Cherry highlighted important developments, some surrounded by a great deal of controversy, concerning the colonisation of Sardinia (1990: 173-5). The main subject of debate is the claim for human presence in the Middle Palaeolithic (up to 100,000 years earlier than in any other Mediterranean island), of which Sondaar *et al.* (1984, 1986; Sondaar 1991, 1998) are the greatest promoters. The claim is based on half a dozen sites in the area near Perfugas in the Anglona region (north-west Sardinia), and on the evidence from Corbeddu Cave (east-central Sardinia). Cherry (1984, 1990, 1992) and Vigne (1992) are sceptical about this Palaeolithic occupation, which, they argue, is based on typology and is not supported by stratigraphy, and also problematically links the extinction of the Pleistocene fauna to human activity.

Sondaar (1998) proposed that the ancestors of the population at Corbeddu could have immigrated only during the earlier part of the Middle Pleistocene, some 200,000 years BP (on the basis of lowered sea-levels offering an opportunity for migration and of so-called 'Clactonian' lithic assemblages reported as Middle Pleistocene by Martini [1992]). He also supported this early human presence by the evolutionary development of Sardinia's Pleistocene fauna. The fact that the Sardinian fauna includes both a decent-sized mammal with high reproduction rates (*Prolagus sardus*) and a deer of 'normal mainland' size was interpreted as implying the presence of a large predator (humans). This argument is based on the observation that the opposite, i.e. lack of predation by large carnivores, leads to dwarfing and slow movement (which is the general pattern of Pleistocene island faunas). Vigne (1990) and Cherry (1992), on the other hand, argued that the size of these animals could imply exactly the opposite, i.e. weak predation pressures, and found it hard to accept that there was no other evidence to substantiate several hundred thousand years of human presence on the island. Tykot (1994: 118) also rejected the early lithic evidence, and remarked on the fact that, if the dating were accepted, the colonisation of Sardinia would be exceptionally early compared to that of other Mediterranean island environments.

The site of Corbeddu Cave deserves further attention (Table 4.4). Cherry (1990: 176) accepts the dating of the first two layers excavated in this cave (Sondaar *et al.* 1984, 1986): Layer 1 produced Neolithic material (dated 6260±180BP = 5563-5226-4783 cal. BC 2σ - GrN-11433) but also the earliest Cardial assemblage yet known in the Mediterranean (8040±100 BP, late 8th - early 7th millennium cal. BC - UtC-22). Layer 2 contained the earliest accepted traces of human activity (in possible association with endemic fauna), dated 9120±380 BP (9053-8088-7428 cal. BC 2σ -GrN-11434). Layer 3, on the other hand, is difficult to interpret, and Cherry (1990) pointed out the unclear human origin of the bone assemblage: the sample produced a date of 13,590±140 BP (14729-14332-13904 cal. BC 2σ - GrN-11405). Cherry (1990: 177) concluded that the problems with Corbeddu Layer 3 meant that it could not be used to substantiate a Palaeolithic occupation of Sardinia (Cherry 1992: 31-36). He did concede, however, that, if human activity could in fact be proved, Corbeddu Cave might provide evidence for frequent occupation during the latter half of the Upper Palaeolithic, and of early sea-crossings, since at that time Sardinia and Corsica formed a single island because of the lower sea level, but were separated from the mainland (Cherry 1992: 34). Tykot (1994) also agrees that if the controversies surrounding Layer 3 are clarified, then the evidence would indicate that Sardinia was settled by at least 14,000 cal. BC. Tykot (1994) accepts that the deposits in Layer 2 of Hall 2 indisputably demonstrate human presence in Sardinia by the early 8th millennium cal. BC. This is consistent with evidence from Corsica and with the Mesolithic levels at mainland sites (Tykot 1994: 120).

In conclusion, the earliest colonisation evidence that is acceptable in full is Corbeddu Layer 2, as well as that derived from a number of later 8th- and 7th millennium BP (7th-5th mill. cal. BC) Early Neolithic Tyrrhenian impressed ware sites, and from the presence of Sardinian obsidian on Corsica in the 8th millennium BP (7th mill. cal. BC) (Tykot 1996: 43-46, 52).

CORSICA

The colonisation of Corsica is generally accepted to have taken place in the 8th millennium cal. BC and is less a matter of controversy than Sardinia, mainly because, as Cherry (1990: 178) put it, there is no Corsican equivalent of Corbeddu Cave. Camps (1988: 22) declared categorically that there was no evidence to substantiate a claim for human presence in Corsica during the Pleistocene, and concluded that the only reliable evidence of permanent occupation occurs in the 9th millennium BP (late 8th - early 7th mill. cal. BC), which is comparable to developments elsewhere in the Mediterranean (Cherry 1990: 178, 180). Nonetheless, claims for earlier occupation of the island exist for Corsica too, a fact that is not surprising since it is generally accepted that the colonisation of Sardinia (for which, as we saw, early claims also exist) is likely to have taken place from mainland Italy via Corsica (Camps 1988).

Claims for an earlier colonisation of Corsica were initially made in the 1950s, on the basis of the finds made by two geologists, Ottman and Bonifay, in a cave on the east coast of Cap Corse, near Macinaghiu. The finds consisted of sediments dated to the interstadial between Würm II and Würm III (ca. 80,000-60,000 BC), including ash layers containing remains of *Cervus cazioti*, an endemic mammal. The numerous Mousterian sites on the Italian coasts at the latitude of Corsica and the Mousterian traces (rare surface lithic industries) on the island of Elba were seen as substantiating early colonisation (Bonifay 1998: 137). Camps (1988: 23) dismissed the finds as being the result of accidental accumulation: no tools were found in the assemblage, and its human origin was disputed since the ash might have been the result of accidental fire. He pointed out that the lack of evidence for human presence contradicted this dating, since such evidence was to be expected had Neanderthals been present. Nonetheless, Camps admitted that Corsica may have been visited on occasion in the middle Palaeolithic, during the Würm period (ca. 70,000 BC), when he envisaged a small group of Neanderthals reaching Corsica, aided by lowered sea levels. Shackleton *et al.* (1984: 313) also suggest that this is a possibility, since although they appear to have left no remains on islands such as Corsica, Sardinia, Malta, and Sicily, Neanderthals would have been able to make such sea-crossings as early as 40,000 years ago.

Recently, Bonifay (1998: 133) has announced that the discovery of new material in the Coscia cave (in the region of Cap Corse) raises once again the question of the first known human occupation of the island. This material, which he dates to the start of the older Würm phase, is in turn used to substantiate claims from the Sardinian sites of apparently Middle or Upper Palaeolithic age - which he admits contain 'industries atypiques et relativement mal datés' (Bonifay 1998: 133). Bonifay claims this is further evidence that the Sardo-Corsican block was inhabited during the Middle Palaeolithic by Neanderthals, whom he ascribes the intention of colonising new territories (1998: 140).

According to Camps, these earlier dates only constitute a 'fréquentation accidentelle' (Camps 1988: 24) as opposed to permanent settlement, a definition that could be extended to the evidence from Corbeddu cave, Layer 3, if that dating were to be accepted. While these renewed claims await further confirmation, the only reliable evidence of earliest settlement in Corsica dates to 8^{th} and 7^{th} millennium cal. BC, and comes from three sites excavated in the late 1960s and early 1970s (Fig. 4.4). Their dates are internally consistent (Table 4.5) and, as pointed out by Cherry (1990: 180), suggest that people practised foraging on the island for at least a millennium before the introduction of farming. Three further sites have become known since Cherry's 1990 update (Vigne and Desse Berset 1995) (see Table 4.5).

Three of the longer-known pre-Neolithic sites are rock-shelters, and have been described as having 'impoverished and culturally undiagnostic material' (Camps 1988: 35). Curacchiaghiu (Camps 1988: 26) is less reliable in view of its stratigraphy and bad preservation, partly due to acidic soils and the fact that the site has been partially destroyed. Araguina-Sennola and Strette have better stratigraphies (Camps 1988: 28- 34), with pre-Neolithic layers (contemporary with Corbeddu Layer 2 – Camps 1988: 24) clearly separated from the early Neolithic by a sterile layer. Araguina-Sennola contained the grave of an individual female ('la Dame de Bonifacio') in its lowest pre-Neolithic level (XVIIIb) (Camps 1988: 31, 34). The burial is similar to those found on the mainland dating from the final Palaeolithic and Mesolithic (although the lithic material is described as 'atypical') and completely different from those used in Corsica during the Neolithic. This, according to Vigne and Desse-Berset, would suggest permanent hunter-gatherer groups on Corsica during the 8^{th} millennium cal. BC (1995: 311).

Level XVIIIa above it contained a hearth (Camps 1988: 29) with the bones of small endemic fauna (apparently hunted by humans), as well as sheep and pig bones, all of which suggested to Camps that these species were domesticated earlier than anywhere else in the Western Mediterranean area (*ibid.*). The layer however is not without its problems, and there is a strong possibility of contamination from other layers (Cherry 1990: 182).

Vigne and Desse-Berset (1995) discuss three other Pre-Neolithic sites in Corsica. The first, Pietracorbara, is in the northern part of the island, near Cap Corse. The deepest layer (layer 9) of the 1.5 m thick stratigraphy produced a pre-Neolithic grave accompanied by rough lithics made of local rocks. Layer 8, above it, produced charcoal, rough lithics, shellfish, and plentiful small mammal bones. However, the two radiocarbon dates are contradictory, with layer 9, supposedly older, being more recent than layer 8 (layer 9: 6920± 300 BP - LGQ 508; 8^{th}-6^{th} mill. cal. BC 2σ; layer 8: 7840 ± 310 BP - LGQ507; 9^{th}-8^{th} mill. cal. BC 2σ). The dates however indicate a recent pre-Neolithic phase of human presence, around the 8^{th} millennium cal. BC (Vigne and Desse-Berset 1995: 312).

The second site is Longone, in a valley in the south of the island, 650 m south of Araguina-Sennola. The Neolithic sequence begins with a sterile layer (5a1-5a2) over a sandy layer (5a3) directly over the bedrock, neither of which has produced any artefacts, although a 15 litre sample of sediment from the sandy layer was sieved and produced 'traces of charcoal and a few animal remains', some bearing 'clear marks of having been eaten by man' (Vigne and Desse-Berset 1995: 313): the remains included large rodents bones (*Rhagamys-Tyrrhenicola*) bearing burn marks; seven bones of *Prolagus sardus* ('rabbit-rat'), three bearing burn marks; seven unidentified small vertebrate remains; and two seashells (one burnt). No radiocarbon date is available for this level, but according to Vigne and Desse-Berset (1995: 313) it should be older than 6320±140 BP (LGQ 617) obtained for layer 4a2 above it.

Finally, the site of Monte Leone, 1 km higher in the same valley as Longone, is a very large rock-shelter. Excavation revealed that the upper two metres of sediment lacked any evidence for human presence, apart from a terminal Late Neolithic grave (Lanfranchi and Vigne, unpublished data, in

Vigne and Desse-Berset 1995). The deepest explored layer (layer 5) was excavated in 1992 over an area of 1 m sq., revealing half of a '50 cm thick multiphase structure', with two hearths ascribed to two separate phases of occupation (Vigne and Desse-Berset 1995: 313). Excavation and systematic sieving produced thousands of small vertebrate bones (fish and mammals), *Prolagus sardus* bones radiocarbon-dated 8225±80 BP (9^{th}-8^{th} mill. cal. BC), seashells, and a few quartz and rhyolite lithics. Four other small soundings showed that this pre-Neolithic occupation extended over an area of 25 m sq.. The site is interpreted as 'the first large Pre-Neolithic site with domestic structures in Corsica' (Vigne and Desse-Berset 1995: 313).

The radiocarbon dates from the six Corsican pre-Neolithic sites cover the 8^{th} and part of the 7^{th} millennium cal. BC. The sites share common characteristics: the rock shelters in particular produced 'idiosyncratic artefacts' and great amounts of small vertebrate bones (Vigne and Desse-Berset 1995: 313). With the exception of Curacchiaghiu (ca. 800 m a.s.l.; 20 km from the present sea-shore), all of them are situated at low altitude, up to ca. 4 km from the shoreline at the time (–35 m). Vigne and Desse-Berset (1995: 313) thus interpret them not as real littoral sites but as settlements on the coastal plain, from where the sea could be reached in less than an hour's walk. The evidence from these sites is taken by Vigne and Desse-Berset to indicate that humans lived on the island by hunting and gathering during the 8^{th} millennium cal. BC, in spite of the lack of large game, by feeding on small terrestrial mammals and birds, by coastal fishing, and by some shell-fish gathering (1995: 316).

Smaller Upper Tyrrhenian Islands

The Mousterian sites on the island of Elba (Lacona, San Martino, and Santa Lucia) and the Lower Palaeolithic evidence from Capri belong to the time when the islands were joined to the mainland at low sea levels (between 20,000-18,000 and around 14,000 years ago) (Shackleton *et al.* 1984: 313; Canestrelli 1998: 9) (Figs. 4.5-4.6). The earliest known cross-sea colonisation of the islands is dated later, to the Early Neolithic.

Neolithic impressed ware is found along the Tuscan coast on the Italian mainland, and on the islands of Giglio (which is second in size in the Tuscan archipelago), Elba (the largest) (Brandaglia 1985; Guidi and Piperno 1992: 310), Capraia, and especially Pianosa, where the Cardial Impressed Ware site of La Scola is known (Ducci and Perazzi 1991). Huge quantities of obsidian blades have also been found on the Argentario promontory on the Tuscan mainland (associated with Late Neolithic cordoned ware, 'Grotta all'Onda' type), and on the islands of Elba, Capraia, Pianosa, Giglio, and Giannutri. The sites of Vigna Vecchia and Grotta delle Capre on Giannutri (Figs. 4.7-4.8) also produced some flint tools and impressed pottery (Vaccarino 1935: 127; Bronson and Uggeri 1970). Both Lipari and Monte Arci Sardinian obsidian have been found on Capraia, without any defined context (Arias *et al.* 1984; Bigazzi *et al.* 1986). Two artefacts from Elba are Sardinian (Hallam *et al.* 1976). All 14 artefacts analysed by Tykot (1996) from the cardial impressed ware site of La Scola on Pianosa (Ducci and Perazzi 1991) are Sardinian. None of the extensive Early Neolithic obsidian finds from Le Secche on Giglio have been analysed, although the excavator attributed them to Lipari (Brandaglia 1985: 59-60). However, since Lipari obsidian was not extensively distributed so far north in the Early Neolithic, and in view of the presence of reduction cores and debris at the site, Tykot (1996: 54) suggests that Sardinia and/or Palmarola are more likely sources for most of the Le Secche assemblage.

The island of Giglio has also been the focus of extensive research by the Soprintendenza Archeologica della Toscana since 1982, and as a result a Middle Bronze Age site was discovered and excavated, with several post-holes, a hearth, a pebbled floor, and a pit. The site, strategically located on a hill overlooking the wide Gulf of Campese, is also the earliest Bronze Age site known in the whole Tuscan archipelago (Bronson and Uggeri 1970: 201; Rendini 1989; Aranguren *et al.* 1992).

Going further south, Palmarola (1.3 sq km) (Fig. 4.9) has produced Chalcolithic material, suggesting that it was first settled in the fourth millennium cal. BC, although Palmarola obsidian was extracted and exported as early as the Middle Neolithic (Tykot 1996: 43). A number of sites in central peninsular Italy, as well as the Foggia area of the Tavoliere

(SE Italy), and further south the area of the Gulf of Taranto at Grotta Sant'Angelo-Cosenza have yielded obsidian from Palmarola (Hallam *et al.* 1976). Obsidian from Palmarola is widespread in northern Italy, but none so far has been identified in France, a fact that, according to Tykot, supports the possibility that obsidian reached the French sites via Sardinia/Corsica rather than Tuscany/Liguria (1996: 56). Obsidian found at San Domino in the Tremiti islands was also reported to be from Palmarola (Cornaggia Castiglioni *et al.* 1962, 1963), but Tykot (1996: 57) argues that this attribution should be taken with caution. In addition, a study carried out by Giaccio and Fumo (1980) indicates Lipari as the most likely source for the obsidian found on the Tremiti (Fumo 1980: 78).

In the 1940s, on the hill of the cemetery on the island of Ventotene, not far from Ischia, Buchner identified the remains of an MBA settlement (ca. 2nd mill. cal. BC) showing similarities to the site of Punta d'Alaca on Vivara (Buchner and Rittman 1948).

In the bay of Naples (Fig. 4.10), as mentioned, Capri has produced Lower Palaeolithic evidence (it was not an island at the time). The site of Grotta delle Felci has produced Middle Neolithic material (including three hearths, seven human burials, painted pebbles, painted wares, grinding stones, and shell and bone ornaments), and there is evidence of the cave being in use until Roman times (Giardino 1998). Ischia was first occupied in the Neolithic. Several Neolithic stone tools were found, especially in the 1960s, in the area of Cilento, very close to the entrance of Ischia's cemetery (Buchner and Gialanella 1994: 26). Finds included Impasto ware, figulina painted ware (similar in style to Serra d'Alto), fishing-net clay weights, flint tools (the flint source is in the Sorrento peninsula), and obsidian blades (from Palmarola) (*ibid.*). A few finds came from the nearby site of San Michele (Buchner and Gialanella 1994: 29). Occupation on Ischia continued into the Bronze Age. There are MBA sites in proximity of natural harbours on the northern and western sides of the island, while there are no sites on the southern coast. An MBA village was excavated by Buchner on the hill of Castiglione (in the area of Casamicciola Terme) in the 1930s. Other prehistoric material comes from Monte di Vico near Lacco Ameno (in the area where Pithecussae would later be founded), on the nearby hill of

Mezzavia (localita Mazzola), and at Punta Caruso, a promontory overlooking the small bay of Forio and the beach at Chiaia (Marazzi 1988).

The tiny island of Vivara (Figs. 4.11-4.13), also in the bay of Naples, was apparently settled for the first time in the late EBA (Fig. 4.14). The oldest levels at Punta Mezzogiorno have produced Mycenaean fragments dated to the early 16th century BC, as has trench E+1A at Punta Capitello (which also displays links with the final EBA of Palma Campania, on the mainland) (Buchner 1938; Tusa 1991; Pacciarelli 1991; Cazzella and Damiani 1991; Marazzi and Tusa 1994). Settlement on Vivara was continuous throughout the Bronze Age. Middle Bronze Age material comes from Punta d'Alaca (end of the 16th - second half 15th century BC), while the most evolved Bronze Age phase is at Punta Capitello (Apennine ware) (Giardino 1994: 69-70). Procida, which is larger than Vivara and only a few hundred metres away from it, has not produced any prehistoric material. This is likely to be a reflection of a lack of archaeological investigation (the island housed a prison for much of the 20th century).

Open air scatters of pottery and obsidian assemblages do not qualify as 'colonisation' *sensu* Cherry (1981). However, the collective evidence from these islands provides a contrast to the view, held until the late 1990s, that 'small Tyrrhenian islands such as Montecristo, Giglio and Giannutri have not been fully surveyed and there is no sign of their occupation before the first millennium BC' (Malone 1999: 45). This seems to still be the case for Montecristo (Fig. 4.15), but not for the other islands. Although their occupation might not have been continuous, there is evidence of a strong human presence in these islands from at least the early Neolithic (if not before) into the Iron Age.

SICILY AND ITS SATELLITES

Sicily is a very large landmass close to mainland Italy, to which it lied closer and/or may have been linked to at times of low sea levels (see Chapter 2). These physical characteristics prompted Cherry to describe it as a 'false island' (1990: 189). Because of the potential existence of a landbridge, several controversial claims have been made for a human presence on Sicily since the Lower Palaeolithic. These claims deserve further investigation; however, more relevant to the study of the initial colonisation of Sicily's small 'satellite' islands is an understanding of the nature of Sicily's Mesolithic societies and of the transition to agriculture in the island. In effect, the island acted as a mainland in that process (Fig. 4.16).

This section starts by reviewing the claims for the earliest peopling of Sicily. Material identified as Lower Palaeolithic has been claimed to come from two provinces: scrapers, points, denticulates, and choppers were identified in the Catania plain (east central Sicily); whereas a number of denticulates, large bifacials, and scrapers were collected in the province of Agrigento (south central Sicily) (Leighton 1999: 22). Leighton, however, has pointed out that there are striking similarities between the Neolithic, Copper, and Bronze Age 'Campignan' stone industries (from south-eastern Italy) and several early Palaeolithic forms, and suggested that these early tools should be regarded with caution (*ibid.*; Palma di Cesnola 1979, 1994). Nonetheless, since Lower and Middle Palaeolithic sites in mainland Italy are known, it is hard to believe that Sicily was completely unoccupied (Leighton 1999: 22).

Further claims have been made for the Middle Aurignacian period (Upper Palaeolithic, ca. 35,000 bp), most notably at the small rock shelter of Fontana Nuova (in the province of Ragusa) (Chilardi *et al.* 1996). The lithic material found there included a blade-based industry (some typically Aurignacian), made from two varieties of flint, one sourced to ca. 100 km from the site. There were no microliths. The assemblage included deer bones (90% of total), displaying burn marks, thus suggesting a human presence, which was confirmed by five human bones, as well as teeth, identified as belonging to the Upper Palaeolithic (Bonfiglio and Piperno 1996; Leighton 1999: 24).

Most of the other evidence for Lower and Upper Palaeolithic human presence in Sicily derives from surface lithic scatters (reviewed by Leighton [1999: 21] and by Mussi [2001: 90-ff]). The unreliability of these early claims seems to be supported by the complete lack of Middle Palaeolithic sites (Mussi 2001: 90; Whitehouse pers. comm.). According to Mussi, the Upper Palaeolithic settlement of Sicily was a 'dead end' (2001: 327). This is because no reliable evidence for human occupation is found in the island until much later, when a new wave of immigrants occupied sites such as Grotta dell'Acqua Fitusa (Bianchini and Gambassini 1973) and Grotta di San Teodoro (Vigliardi 1968). There is good evidence to show that Sicily was widely inhabited by the later stages of the Upper Palaeolithic (later phase of the Epigravettian, from about 15,000 to 10,000 cal. BC). This was in fact the result of a maritime crossing colonisation into Sicily (Mussi 2001: 332). By this time, Sicily had become essentially a cultural extension of Southern Italy, with several sites replicating the settlement pattern on the mainland, while there is no evidence to support contact with North Africa at this stage (Leighton 1999: 23, 28; Mussi 2001: 328).

Grotta dell'Uzzo has produced evidence for the transition from the Mesolithic into the Neolithic. A series of radiocarbon dates indicate that the cave was occupied from the 10^{th}-9^{th} until the end of the 7^{th}-6^{th} millennium cal. BC and there is evidence of its use until the EBA (Piperno and Tusa 1976; Piperno *et al.* 1980; Tagliacozzo 1994: 9; Tusa 1996; Piperno 1985, 1997: 137) (Tables 4.6 and 4.9). Evidence that occupation was permanent is provided by the seasonality of the fish and migratory birds found in the cave (Tagliacozzo 1994: 34). There is no precise date for the beginning of the Neolithic, since a thousand-year gap currently separates the transitional phase (dated ca. 7000-6500 cal. BC) from the earliest Neolithic date so far available (5750-5500 cal. BC), although there is evidence from two trenches (W and X) that the Neolithic extends below the dated layers (Tagliacozzo 1994: 10). Three Neolithic phases have been identified so far, two Early Neolithic and one Middle Neolithic. Cattle, sheep, and goat seem to have been introduced already domesticated around 6000 cal. BC; however, hunting (red deer) and fishing continued (Tagliacozzo 1994: 35).

Various models of occupation of the cave have been proposed: initial human occupation seems to have been occasional, becoming more intensive throughout the Mesolithic, and ending with permanent occupation in the transitional period (Tagliacozzo 1994: 33). In the first Neolithic phase, the cave was still used for permanent occupation, while during the second Neolithic phase it gradually became a seasonal shelter used by shepherds and their animals (*ibid.*). The cave has also yielded a wealth of environmental information, indicating that there was substantial forest cover from the earliest phases. The animal remains and the increase in resources exploited indicate that the climate became wetter between the end of the Mesolithic and the transitional phase (*ibid.*).

The information from Uzzo Cave provides an insight into the environmental conditions at the time when Sicily's smaller islands also began to be settled. In particular, it is worth noticing that nearly 40% of the 152 obsidian artefacts from Grotta dell'Uzzo come from Pantelleria (Francaviglia and Piperno 1987), providing evidence of an open water-crossing of at least 100 km in the Early Neolithic (Tykot 1996: 58, 61). Collectively, Sicily's smaller surrounding islands have produced evidence related to a number of activities, ranging from visitation and utilisation to actual settlement.

Ustica

Ustica (8 sq km) is an isolated volcanic island ca. 53 km north of Sicily (Fig. 4.17). The island's earliest known site is that of Faraglioni, a Middle Bronze Age settlement excavated by the Soprintendenza ai Beni Culturali di Palermo since 1974 (Holloway and Lukesh 1995, 1997) (Fig. 4.18). Four phases were identified, from the initial building of the huts to the subsequent building and repairing of the rampart, which in parts reaches a height of 4 m (Holloway and Lukesh 1997: 455).

Mannino (1980-1981; 1982) interpreted the site as a large village: the remains of a hut on the very edge of the cliff and of a building and prehistoric material found on the 'grande Faraglione', an isolated sea-rock facing the site, were interpreted as evidence that the village originally extended over a wider area that had subsequently collapsed into the sea. According to Mannino, the overall extent of the village may have reached 4,000 m sq., with up to 300 huts (Mannino 1982: 281). Holloway and Lukesh (1997: 460) disagreed with this interpretation, and believed that the number of huts was never more than twenty (they also interpret the remains on the Faraglione as a light-house built when the rock had already become separate). The small cemetery, just outside the walls towards the east, also supports the idea that the village was small (Holloway and Lukesh 1995: 77-78).

Isole dello Stagnone

Set in the lagoon of the Stagnone, a natural marine reserve up to 3 m deep (0.50 m on average), and separated from the north-western coast of Sicily by a coastal ridge, are the islets of San Pantaleo (better known as Mozia), Isola Grande, La Scola, and Santa Maria (Fig. 4.19). San Pantaleo-Mozia (45 ha) lies 8 km north of Cape Lilybaeum (modern Marsala), in the north-west of Sicily, and just 1 km from the nearest coast, to which it is connected via a submerged causeway that is still in place. The island is famous for its Phoenician colony (Motya), founded there in the second half of the 8th ca. BC, even if Bourain *et al.* mention briefly that it was first occupied in the Bronze Age (1992: 301), without adding any further information. No early prehistoric material is reported from the other islands (Bourain *et al.* 1992).

Ègadi Islands

The islands of Favignana, Levanzo, and Marettimo, together with the rocks of Formica and Maraone, and Colombaia (just off the NW coast of Sicily, at Trapani) compose the Ègadi archipelago (Figs. 4.19-4.22). There are hundreds of caves on Marettimo (Fig. 4.23), but so far only Grotta del Genovese, on the island of Levanzo, has provided evidence for early human frequentation of these islands (Late Upper Palaeolithic/Mesolithic – followed by a Neolithic phase) (Graziosi 1962) (Fig. 4.24). Layer 3 provided dates of 11,764-11,094 and 11,034-10,737 cal. BC (Leighton 1999: 26). Because of the lower sea level, Levanzo was part of the extreme north-west corner of Sicily at the time of this initial occupation, although it had become an island by the time of its Neolithic settlement (see Chapter 2).

Grotta del Genovese is a 35-m long chamber (separated from the antechamber by a low passage), famous for two series of rock art. Graziosi (1962) first made the interesting suggestion that the difference between the two figurative styles in the cave showed two moments in the life of the island, first when it was an upland surrounded by plains, and then when these plains were flooded and Levanzo became separated from Sicily (and the Palaeolithic fauna disappeared). Indeed, the apparently older incised style represents zoomorphic and naturalistic subjects (large fauna), while the other more recent style (probably dated to the Neolithic, 4th or early 3rd mill. cal. BC) in black paint depicts human figures and schematised quadrupeds (identified as bovines, pigs, and deer) and large fish or dolphins (Pluciennik 1994: 60) (Fig. 4.25).

In 1968, Bisi surveyed the island of Favignana (Fig. 4.26). Only a few of the several caves explored there (Grotta delle Pecore or della Madonna, Grotta della Ucceria) indicate human frequentation, in the form of anthropogenic assemblages (shell middens) of *Helix*, *Trochus*, and *Patella cerulea* and *ferruginea* and a rather impoverished lithic industry, which he identified as being similar to the pre-ceramic phase from Levanzo. Only two caves on the slopes of the Montagna Grossa, a mountain range that crosses Favignana width-wise, have produced impasto pottery fragments (both black- and red-painted) of non-specified period, which Bisi (1968: 25) identified as being possibly Bronze Age. Bisi (1968: 27) also found several burials cut into the soft tufa caves, and saw continuity in the architectural elements and carved structures from prehistoric times into the Roman period. The rock-cut prehistoric tombs are found in the NE of the island in Località Torretta and near the old cemetery, where there are also hypogeic chambers that were re-used and transformed from Punic times until modern times. The hypogea are decorated with incisions: anthropomorphic figures or arrow figures and fish, which Bisi (1968: 27-28) saw as being stylistically similar in character to those of Grotta Genovese on Levanzo.

Aeolian Islands

The seven islands of Alicudi, Filicudi, Lìpari, Panarea, Salina, Stròmboli and Vulcano lie in the lower Tyrrhenian, north of Sicily, between 20 and 40 km from the coast and between 55 and 115 km from southern Italy (Fig. 4.27). In 1950, excavations by Bernabò Brea and Cavalier focused on the Lipari Acropolis, which was described as 'a real tell like those of the Near East'

(Bernabò Brea 1957: 49). Bernabò Brea and Cavalier's original chronology, although slightly modified (some phases have been either lengthened or back-dated) through recent re-calibration of older radiocarbon dates, is still widely accepted (Leighton 1996: 3; Malone *et al.* 1994: 169) (Fig. 4.28, Table 4.7). An important result of this date revision process has been the attribution of Neolithic painted wares to an earlier period than originally believed, overlapping in part with Stentinello pottery (*contra* the idea of an extended early 'pure-impressed' ware phase) (Whitehouse 1969; Leighton 1996: 5).

Only Lipari, Salina, and Filicudi have evidence of early Neolithic Stentinello occupation (generally believed to be the earliest Neolithic culture known in Sicily), suggesting these were the first to be settled (Figs. 4.29-4.30). Cherry (1990: 190) noted that, although the Aeolian islands have not yet produced material pre-dating Stentinello, there is evidence for pre-Neolithic exploitation of Lipari obsidian, which is found in Sicily and mainland Italy during the 9^{th} millennium BP (8^{th}-7^{th} mill. cal. BC), indicating that the islands were being visited before their settlement. The earliest known site on Lipari is the village of Castellaro Vecchio (Bernabò Brea 1957). Its upland position was more favourable for agriculture and pasture than for navigation and trade, even if the huge amounts of obsidian debris indicate that the obsidian industry was an important activity in the village (Malone 1999). The oldest tuna fish bone found in Lipari comes from a burial dated to the Middle Neolithic (Bernabò Brea and Cavalier 1960: 113), and was interpreted by Castagnino Berlinghieri as an unusual 'one-off', perhaps a ritual deposit, as none others are known from contemporary settlements. This lack of evidence for deep sea ventures was interpreted as a sign that the activities of Lipari's Neolithic colonisers focused on the land more than on the sea (Castagnino Berlinghieri 2002: 230). In Bernabò Brea's original chronology (1957), settlement at Castellaro Vecchio was followed by that of the Acropolis. This chronology, however, is based on Bernabò Brea's distinction between their pottery styles (impressed and painted) and, as mentioned, the two styles (and hence the two sites) can be seen as being roughly contemporary.

Turning to the other islands, according to the accepted chronology, Salina and Filicudi were settled roughly at the same time as Lipari; Panarea was first settled in the Middle Neolithic; Stromboli was occupied for the first time in the Early Copper Age (Piano Conte phase), or the middle of the 4th millennium cal. BC, and Alicudi was first occupied in the Early Bronze Age (2nd mill. cal. BC) (Bernabò Brea 1957; Tusa 1992; Balistreri *et al.* 1997; Stoddart 1999a). Evidence of prehistoric settlement (in the form of hut remains) is found in all the islands except Vulcano, possibly as result of the emergence of Vulcanello, a volcanic formation that began to form around AD 186 and that may have buried traces of previous occupation (Castagnino Berlinghieri 2003: 72) (Figs. 4.31-4.32). However, some evidence has survived. Some prehistoric burials, dated to the first half of the 2nd millennium cal. BC, were excavated in the area of Porto Levante, near the Faraglione Grande, and in the area of the Piano on the island of Vulcano (Bernabò Brea 1957; Giustolisi 1995). There is also evidence that Vulcano was visited for the exploitation of sulphur and possibly alum in the Middle and Late Bronze Ages, as part of Mycenaean trading interests in Sicily and the Aeolian islands (Bernabò Brea 1957: 120; Giustolisi 1995: 52; Castellana 1998; Leighton 1999: 132, 157, 181).

The Pelàgie islands and Pantelleria

The Pelàgie islands and Pantelleria form a series of stepping-stones between Sicily and North Africa (Figs. 4.33-37). Lampedusa and Lampione are calcareous and belong to the continental shelf of Africa. Their land is friable in places, causing the coastline to be eroded by sea action at a striking rate of about 1 m a year. A map drawn in 1847 shows Capo Ponente, the western tip of Lampedusa, jutting 150 m further out to the sea than it does today (La Rosa 1993: 47). Linosa is of volcanic origin, and geologically belongs to Sicily. A Stentinello site has been excavated on Lampedusa (5th-4th mill. BC) containing obsidian from Pantelleria (ca. 145 km away) (Radi 1972).

The earliest settlement remains on Pantelleria, the village of Mursia and its adjacent necropolis, found on the western coast of the island, have been dated to the EBA (Orsi 1899; Tozzi 1968, 1978). The island is famous for its megalithic funerary monuments, or 'Sesi', which were originally studied by Orsi (1899). Mursia was protected on the seaward sides by sheer cliffs, and by an imposing wall (200 m long, 7-8 m high and with a 10 m wide base) towards the interior (Tusa 1983: 276). The oval huts (some with pebbled floors) had hearths inside stone cists, stone vases, and clay slabs fixed in the floors. The pottery found is both purified and coarse *impasto*, made with clay from either Sicily or North Africa. The style shows links with the EBA Sicilian Rodì-Vallelunga-Boccadifalco culture, and, although the island lies much further south, with the Aeolian island culture of Capo Graziano (*ibid.*). The lithic industry is almost exclusively obsidian-based, extracted from the south-eastern side of the island (Tusa 1983: 274). Three sources have been identified on the island: Balata dei Turchi, Gelkhamar, and Lago di Venere (Tykot 1996: 43). Pantelleria obsidian, or 'Pantellerite', is readily distinguishable from other western Mediterranean sources because of its chemical content, which makes it look greenish. The low quality of this obsidian is reflected in the lithic repertoire, with blades tending to be thick (*ibid.*)

The economy at Mursia was based on farming (grindstones and sickles were found) and animal herding (80% sheep bones, 20% cattle, while pig remains are extremely rare), supplemented by hunting and fishing (Tusa 1983: 275). Tusa (1997: 389) argues that Pantelleria was already populated in the 5th millennium BC, although Mursia indicates that it was permanently settled only by the 3rd millennium BC. Evidence to support Neolithic occupation is still lacking however, and relies on obsidian found in Neolithic contexts elsewhere (evidence that is more likely to relate to the island's visitation rather than permanent occupation, cf. Melos, Lipari): Lampedusa, Malta, Sicily, and Ustica (Francaviglia and Piperno 1987; Tykot 1995; Tusa 1997: 389), Italy (Bigazzi *et al.* 1992b), France (Williams-Thorpe *et al.* 1984 in Tykot 1996: 56), and Tunisia (Camps 1988: 47). Pantellerian obsidian was found in Tunisia at Kef Hamda near Maktar in contexts dated as early as 7445±125 BP and 7610±125 BP (ca. late 7th-early 6th mill. cal. BC), and subsequently in a MN context near Hergla, on the coast, dated 5270±140 BP (=4420, 4350-3800 cal. BC 2σ) (Camps 1988; Tykot 1996).

Maltese Islands

The earliest known material from the island of Malta is Early Neolithic in date and comes from the sites of Skorba (Trump 2002: 23) and Ghar Dalam cave (Evans 1984) (see Fig. 4.38-4.39, Tables 4.8 and 4.9). The date from Skorba has recently been re-calibrated (2σ) as 5266-4846 cal. BC (Trump 2002: 23), while the dates from the cave are 5433-4691 cal. BC (BM-378) and 5209-4172 cal. BC (BM-216), indicating the presence of 'well-established' farmers around ca. 5000 cal. BC (i.e. implying a sea-crossing of just under 100 km), and that the first settlement of the island might have been earlier (Trump 2002: 54). However, there is no known earlier evidence, which may either confirm what Cherry stated over ten years ago, i.e. that people from Sicily did not reach Malta across the land bridge that existed from time to time during the Palaeolithic (1990: 191), or suggest that they left no visible traces of this passage (Trump 2002: 25). Recent claims of much earlier structures (now allegedly under water) are dismissed by Trump as 'the work of mermaids' (2002: 14).

The best evidence for initial occupation comes from Skorba, rather than Ghar Dalam cave (after which the Maltese EN is named) (Trump 2002: 28). The cave, which has also produced Pleistocene faunal remains (not associated with humans), yielded very little impressed pottery from a disturbed deposit (2002: 56-57). Early Impressed Ware sites are also known from the nearby island of Gozo, at the cave of Ghajn Abdul, and at Ta' Kuljat and Tac-Cawla, where two surface scatters were identified (Trump 2002: 28).

Evans (1984: 490) claimed that the earliest human occupation of the Maltese islands belonged to a late stage of the western Mediterranean Impressed Ware cultures. Trump also described Ghar Dalam as an 'evolved Stentinello derived from Impressed ware' (1996: 174). However, he also noted that the earliest Ghar Dalam date of 6140±160 BP (BM-378, 5433-4691 cal. BC 2σ) is close to Poggio/Piano Vento (near Agrigento in Sicily), which is described as 'pre-Stentinello' (Tusa 1994), and dated 6130±90 BP (A-4474, 5296-4834 cal. BC 2σ) (*ibid.*). Definitions apart, the Neolithic package brought to the islands is very close to that found in Sicily and

Calabria (impressed pottery, flint, chert and obsidian flake lithics; sheep, goat, pigs, dogs, and cattle) (Malone 1999; Stoddart 1999b). Camps (1988: 45) also believed that the presence of such a well-established Neolithic package on Malta suggested pre-Neolithic frequentation of the island (for which, as already mentioned, there is no evidence). Trump (1996: 174) has recently pointed out the problems with relating the initial occupation of the island and establishing the duration of that phase based on just a handful of dates. The early dispersed 'small encampments' (Stoddart 1999a: 69), which as mentioned were very similar to their Sicilian counterparts, were apparently replaced by a nucleated pattern at the start of the 4th millennium cal. BC, when differences with Sicily started to emerge, particularly in the mortuary sphere (Zebbug phase) (Stoddart 1999b: 140). These differences culminated, in the mid 3rd millennium cal. BC, in the phase of temple building (Tarxien temple phase), which lasted roughly from 3,500 to 2,500 cal. BC (*ibid.*). The subsequent development of human settlement on Malta is dealt with in more detail in Chapter 7.

NORTH AFRICAN ISLANDS

The islands considered here are: the island of Plane, the Habibas islands, Rachgoun (ancient Siga), and the Chaffarina islands (Mediterranean Morocco or western Algeria); and Zembra, the Cani islands, the two Kerkenna islands, and Djerba (Tunisia) (Figs. 4.40-4.41). Some systematic work was carried out in these North African islands in the 1940s and 1950s, mainly by French archaeologists. Balout claimed that the islands formed a separate 'province', apparently untouched until the Neolithic, and possibly later (1955: 140). The North African shores were densely inhabited during the Neolithic, both in caves and rock shelters, and also in open air sites (hearths in the middle of dunes or shell middens). In all of these sites, marine fauna, especially seashells, is abundant but not exclusive, suggesting a mixed economy also based on terrestrial molluscs and mammals. While there is little archaeological evidence (e.g. bone harpoons) to support actual fishing (Souville 1958: 315, 344), there are indications that the Neolithic inhabitants of these shores frequently went to offshore or littoral islands, and that these visits lasted some time, judging from the great quantities of debris derived from stone tool manufacturing found there (Souville 1958: 342). These island visits are unlikely to have been prompted by Neolithic contacts between western North Africa and the Iberian peninsula or between the north-eastern coast of Tunisia and Sicily. This is not so much because it is only with the following Eneolithic or Copper Age that such contacts are broadly attested (Balout 1955; Souville 1958: 343; Cintas 1961: 16; Gilman 1975: 125), but because all the North African islands considered here are very close to the coast, suggesting that their exploitation was part of a much more localised process. The islands, however, were clearly not unaffected by these contacts, all 34 pieces of obsidian found on the small island of Zembra having been imported to the island from Pantelleria (Tykot 1996: 59).

The earliest material identified on the islands is described as Neolithic, belonging to either of the two main North African Neolithic traditions: the 'Iberomaurusian' and the 'Capsian' Neolithic. Some clarifications may be useful at this stage, before the review of the data from the islands themselves. The terms Iberomaurusian and Capsian refer to two distinct preceding Epipalaeolithic traditions, which succeeded the previous so-called Aterien (Acheulian), or Upper Palaeolithic culture, in different areas (Balout 1955: 5). The original distinction was made both on a spatial and on a chronological basis (Camps *et al.* 1968: 9; Roubet 1979: 56). Until the 1970s, all radiocarbon determinations for the Iberomaurusian fell before 8000 cal. BC (with a floruit in the 12th mill. cal. BC), while dates available for the Capsian nearly all fell after 5000 cal. BC, resulting in a conspicuous gap (Camps *et al.* 1968). The two traditions displayed different characteristics: Iberomaurusian sites typically had an abundance of backed blades, few geometric microliths, some microburins, bifacially worked arrowheads, ostrich eggshell, and decorated pottery, and were generally found in the west and along the coasts (particularly in the Oran caves of northern Algeria). The Capsian sites, mainly 'escargotières' (shell middens), were distributed in the east and in the interior (especially eastern Algeria and southern Tunisia) (Gilman 1975: 1). New dates have become available since the late 1980s, refining this picture and indicating some chronological and spatial overlap between the two traditions (Thomas 1993). In particular, the site of Kef Zoura in northern Algeria produced some earlier dates for the Typical and Upper Capsian, eliminating the gap with the Iberomaurusian. The Typical Capsian dates now range from the early 8th to the mid-6th millennium cal. BC (SMU-712: 7440±130 BP, SMU-1121: 6440±170 BP), and those for the Upper Capsian from the mid-5th to the mid-4th millennium cal. BC (SMU-1095: 5640±60 BP; SMU-1099: 4570±170 BP) (Close 1988: 159; Thomas 1993: 24).

Mediterranean Morocco And Western Algeria

Ile Plane

The island of Plane is ca. 8 km away from the Baie des Andalouses (Souville 1958: 340). Vuillemot collected strongly wind-eroded flint blades on the whole island, with concentrations in two areas, the plateaux du Phare and du Sémaphore. The industry is blade-based, with several raw cores, arrowheads, and long bifacial tools of Saharan type. Some finds were also collected inside three caves on the island, defined as 'industrie atypique' and possibly earlier than the Neolithic (Vuillemot 1954: 65).

Iles Habibas

Further west, the archipelago of the Habibas, also opposite the Baie des Andalouses, was surveyed by Louis Gentil, Doumergue, and Vuillemot, who collected on the larger island a great quantity of flint blades, together with some pieces in quartzite and reddish obsidian, which appears to have been worked on the island, as well as the older Atérien industry (Souville 1958: 340). The presence of Atérien on the Grande Habiba is linked to lowered sea levels (Balout 1955: 482).

Rachgoun

Rachgoun is a small island opposite the mouth of the Oued Tafna (the site of ancient Siga), 2 km from the Moroccan coast. On this islet, a blade industry comparable to that found on the Iles Habibas has been collected, with flint bladelets and blades, all apparently Neolithic in age. The presence of earlier Atérien is disputed (Souville 1958: 341), or once again linked to lowered sea levels (Balout 1955: 482). The island is also known for the site of the Nécropole du Phare, which has revealed cremation and inhumation burials containing Phoenician material dated to the 7th c. BC, and indicating contacts with contemporary sites in Iberia. On the southern side of the island, the remains of domestic dwellings were found, made of stone blocks joined with clay, containing material of the 7th c. BC and no later than the 5th (Vuillemot 1955, 1965; Bourain *et al.* 1992: 369).

Iles Chaffarinas

The archipelago is made up of three islands: île du Roi, d'Isabelle II, and du Congrès. The islands were surveyed in the mid-1950s by Posac. The first two islands produced very little in terms of the typical Neolithic blade industry. On the larger island, Congrès Island, already visited by Pallary in the early 1900s, Posac (1956) collected more than 330 stone pieces, half made of flint, the rest of chalcedonite or quartzite (Souville 1958: 341). The repertoire included cores, blades and bladelets, geometric microliths (trapezes and triangles), burins, microburins, and scrapers. These types are generally comparable to the lithic industry found in the islands of western Algeria (Souville 1958: 341). In addition, there were fragments of ostrich eggs, huge amounts of snails, and some Neolithic impressed and incised pottery. On the opposite shore, on a semi-island at Peña del Burro, 6 km from Melilla, which was probably separated from the mainland in prehistoric times, Souville remarked a dozen flint blades, half atypical, and others of the typical bladelet industry (*ibid*).

Tunisian Coast

Zembra

The island of Zembra is 12 km north-west of Cap Bon. It is a rock 432 m high, described by Bourain as a 'natural fortress', with one small inlet on the south coast, where the remains of an otherwise unidentified 'ancient' port were found (Bourain *et al.* 1992: 88). Tykot examined 34 pieces of obsidian found during surface surveys and excavation on the island, and remarked that all of them were green in transmitted light and thus from Pantelleria (1996: 59).

Iles Cani

Along the Tunisian coast, off the promontory of Cap Bizerte, which is 6 km north of the town of Bizerte and 65 km NW of Carthage, are the Iles Cani. On the largest of these, 23 km NE of Bizerte, a hoard of bracelets, ingots, and 150 silver coins was found, possibly buried a little before the fall of Carthage (Bourain *et al.* 1992: 74).

Iles Kerkenna

The two Kerkenna islands, Chergui and Gharbi, ca. 20 km off Sfax in Tunisia, belonged to the empire of Carthage. Herodotus (Histories IV 195) has left an account of these islands (Bourain *et al.* 1992: 245). No earlier material is documented (Fig. 4.42).

Jerba

Further to the south, the island of Jerba delimits the gulf of Gabès to the east. The island is the largest of the North African coast (568 sq. km), with a 125-km long coastline (Fig. 4.42). Jerba has no internal relief and no rivers or springs. The only water comes from cisterns and wells, which provide slightly saline water; nonetheless, the island is cultivated with olive-trees (Fentress 2000, 2001). The very low sea bottom around the island and the large variation in tide make Jerba very good for fishing, but caused the sinking of Roman vessels in 253 BC (Polybius I 39, 3-4). The island is littered with Punic ceramics and has many pre-Roman burials (Fentress 2000, 2001; Drine *et al.* forthcoming). To the north, the site of Henchir Bourgou was first occupied in the 4^{th}-3^{rd} c. BC (Bourain *et al.* 1992: 134; Drine *et al.* forthcoming). No earlier material is mentioned.

Libyan Coast

Seal island and Bombah (or Burdah) Island

Off the Libyan coast, in the Gulf of Bombah, Seal island and Bombah (or Burdah) islands provide the only good anchorage for small craft (Bates 1914: 5). Seal island is flat and low, and suitable for human occupation; while Bombah island is described as 'a steep uninhabitable mass of granular limestone' (Bates 1914: 5). No material is reported from these islands, even though the coves of the Gulf of Bombah provide, with Benghazî, the best access from the coast to the interior, via the Gebel el-Ahdar and the Gebel-el-Akabar natural passes (*ibid.*).

Marsa Island

The Marmaric coast of Libya, from the Gulf of Sollum to the Egyptian Delta, is a long dry stretch (ca. 450 km) with several harbours for small craft, such as Marsa Matruh (Marsa or Bates Island) (Bates 1914: 7; Hulin and White 2002: 168) (Fig. 4.43). The small island (which is oblong in shape, measuring ca. 135 by 55 m and rising to a maximum height of 6 m asl), set in a salt-water lagoon, was possibly the westernmost inhabitable spot along this coast (White 2002: 34; Hulin and White 2002: 172). Structural remains are few (White 2002: 75), while the ceramic reports show that activity on the island started in the 15th/14th century BC (based on Aegean material) and continued into the 13th (Egyptian/Palestinian material) (White 2002: 35; Hulin and White 2002: 175).

ADRIATIC ISLANDS

Bernabò Brea (1957) suggested that the Adriatic islands (the Tremiti and the Dalmatian islands) formed a 'bridge' providing an ideal conduit for the first Impressed pottery reaching Italy from the east (Fig. 4.44). This possibility seems confirmed by parallels between EN Impressed Italian wares and Late Neolithic Dalmatian pottery (Fusco 1965: 88; Petrić 1975; Bass 1998: 167).

Tremiti Islands

Cherry remarked in his 1981 paper that, on the Italian side of the Adriatic, the Tremiti islands had produced Early Neolithic pottery, whilst Pianosa, in the central Adriatic, showed no evidence of having been occupied prior to the Chalcolithic. These discoveries were mainly made by Zorzi, who in the 1950s identified unmistakable evidence for human presence on the Tremiti islands from the Early Neolithic onwards. This evidence was found primarily on the island of San Domino (Fig. 4.45), where Zorzi identified three village sites and a burial site (dated to the Early, Middle, and Late Neolithic). The nearby island of San Nicola seems to lack such concentrations of Neolithic material, and the earliest material known relates to the post holes of an Iron Age hut; further finds included Classical and Hellenistic graves (Figs. 4.46-4.47), and the remains of two Roman houses (Fumo 1980).

Zorzi (1950, 1954, 1955a, 1955b, 1958, 1959, 1960) and Palma di Cesnola (1965, 1967) identified the following sites (all from the north-western side of San Domino) (Figs. 4.48-4.49):

1. San Domino, Prato Don Michele, near the Cisterna dei Benedettini: Impressed Ware village (early Neolithic, 7^{th}- 6^{th} mill. cal. BC);

2. San Domino, Cala Tramontana, settlement: Ripoli Trichrome and Scaloria ware (or Apulian Trichrome Ware) (Middle Neolithic, 5^{th}-4^{th} mill. cal. BC);

3. San Domino, Cala Tramontana, burial site, Diana-Bellavista ware (5^{th}-4^{th} mill. cal. BC Late Neolithic graves dug in earlier settlement levels);

4. San Domino, another settlement in the pine wood near Cala degli Inglesi, with Serra D'Alto pottery (Middle Neolithic, 5^{th}-4^{th} mill. cal. BC).

Some isolated finds are also worthy of notice:

5. San Nicola, few ceramics and large lithic scatter on north-eastern part (Figs. 4.50-4.51), including six fragments of obsidian (Fusco 1964: 194; Fumo 1980: 49-50);

6. Cretaccio (Fig. 4.52), isolated find of a 'large flint artefact' (Fusco 1964: 192); several flint tools (scrapers, blades, bulins) and three obsidian fragments (Fumo 1980: 46);

7. Caprara (Fig. 4.53), two obsidian fragments and several flint tools (Fumo 1980: 44).

In the Gargano-Tavoliere area, several off-shore islets have yielded huge quantities of prehistoric material, some dated as early as the Lower Palaeolithic (when they were attached to the mainland), e.g. the small offshore Isola di Campi, off the Gargano headland (Gambassini *et al.* 1971: 460; Russi, 1969: 376; Palma di Cesnola and Mezzena 1971: 489; Jones 1987: 116). The Tremiti islands are further away from the coast, but lie within sight of the Gargano peninsula and the Lake Varano and Lake Lesina lagoons (Fig. 4.54). However, as mentioned, they have produced no material clearly predating the Early Neolithic.

Dalmatian Islands

On the eastern coast of the Adriatic, archaeological investigation has focused on the Central Dalmatian islands, mainly Hvar, Vis, Brač, Šolta, and, further south, Korčula, Lastovo, Sušac, and Mjlet (Bass 1998; Gaffney *et al.* 1997, 2000) (see Table 4.10 for radiocarbon dates). Far less information is available for the northern Adriatic islands, although a few impressed ware sites have been recorded between the islands of Cres and Krk (Bray 1966: 100) (Fig. 4.55). The Palaeolithic and Mesolithic periods are poorly represented in the central Dalmatian islands. Presumably this reflects the results of considerable land loss caused by rising sea levels in the Adriatic basin between 8500-6000 cal. BC (Shackleton *et al.* 1984). However, excavations by Čečuk (1981) at Kopačina on Brač have provided evidence for the Epipalaeolithic (or Mesolithic) (Bass 1998: 178), and Gaffney *et al.* suggest that more Epipalaeolithic evidence can be expected at other cave sites (2000: 186). Radiocarbon dates in the region demonstrate a south-north spread of sites from the eighth millennium cal. BC onwards (Chapman and Müller 1990). Most of the larger islands display Early or Late Neolithic impressed (as well as plain) wares and monochrome ceramics (Bass 1998: 173) from 7th and 6th millennium cal. BC contexts; the smaller islands were colonised in either the Bronze or the Iron Age, although Palagruža, the smallest (0.3 sq km), has yielded Early Neolithic material (Bass 1998).

On the island of Palagruža, an open site has yielded impressed ware pottery and has been dated around 6000 cal. BC (Hayes *et al.* 1993, Kaiser and Forenbaher 1995). The Adriatic Islands Project survey located several other places on Palagruža and nearby even smaller Mala Palagruža with signs of Early Neolithic, Copper Age and early Bronze Age activity (Gaffney *et al.* 2000: 187). Mala Palagruža has an abundant source of grey-blue flint, which is easily collectable at the bases of cliffs, and there is evidence to suggest that low-intensity mining of this mineral began on Mala Palagruža in the Neolithic (Gaffney *et al.* 1997, 2000).

Hvar seems to have been occupied at least from the early Neolithic (Gaffney *et al.* 1997: 11). There are no certain finds of Palaeolithic or Mesolithic date, although some claims have been made for later Palaeolithic material. The Neolithic is mainly represented in cave sites (Gaffney *et al.* 1997: 24), most of which were investigated by Novak (1955). Of 24 known sites, Markova Špilja is the only cave that has EN occupation (Gaffney *et al.* 1997: 24; Bass 1998: 175). Grapčeva and Markova Špilja yielded later Neolithic material, particularly the distinctive red-painted pottery (Novak 1955, 1959). In 1996, Grapčeva cave was re-excavated by the Adriatic Islands Project. The excavation showed that the cave was used occasionally for a period lasting at least 3500 years, from the Late Neolithic (ca. 5th mill. cal. BC) to the Bronze Age. Environmental analysis revealed the presence of goat and/or sheep, marine molluscs, few fish remains, and some wild resources (acorns). Occasional isolated human bones (most of them fragmented) indicate that the cave may have been used as a burial place, or for other ritual purposes requiring further investigation (Gaffney *et al.* 1997, 2000).

On the island of Brač (Fig. 4.56), the earliest evidence comes from Mesolithic layers from the cave site of Kopačina Špilja. The material from a shell layer directly above the Late Mesolithic material has been dated to just before the first half of the 7th millennium cal. BC, i.e. after the island became insular owing to rising sea levels (see Chapter 2), making this 'the earliest insular evidence in the Central Adriatic basin' (Bass 1998: 172). A series of open-air lithic scatters have also been identified, though there is no clear EN evidence (Gaffney *et al.* 2000: 187).

On the north coast of Vis, the cave of Krajicina Spilja, excavated in 1994, produced Early Bronze Age material (Gaffney *et al.* 1997; 2000). This layer overlies an undated deposit of mixed charcoal and shell (marine and terrestrial). The excavators, Kaiser and Vujnović (1995) noted that shell middens, which are often found to predate the EN layers, occur frequently in caves on the mainland, and Bass suggests that they possibly mark the Pleistocene to Holocene transition (1998: 172). Isolated finds of early Neolithic, late Neolithic, and Iron Age pottery in the cave indicate sporadic visits to the cave over a long period of time (Gaffney *et al.* 1997, 2000).

The earliest known material from the island of Korčula is dated to the Early Neolithic (Vela Špilja). Bass (1998: 172) mentions a layer in Vela cave without ceramics, but containing lithics, animal bones, and shells, as well as two graves, found by the excavators (Čečuk 1989) under the earliest Impressed Ware layer, which has been little investigated and may indicate earlier occupation. Another EN open air site recently discovered at nearby Smokvica awaits further attention (*ibid.*).

The island of Solta, 16 km south of Split, was explored in 1994 by the Adriatic Islands Project survey, which identified 215 archaeological sites (until 1986 only 37 sites were known). Thirty-three of these sites were prehistoric in date and included four hillforts and several burial mounds. At Gornja Polja, several groups of such mounds were recorded, some of which dated to the Late Bronze Age (Gaffney *et al.* 1997, 2000).

On the island of Sušac, four EN sites have been identified. Three contained diagnostic Impressed Ware pottery belonging to the earliest phase (Müller 1988); while one had 'severely abraded pottery of typical EN fabric' (Bass 1998: 169). The earlier pottery from Susač is similar to that found at Coppa Nevigata (Italy) and Prato Don Michele (Tremiti islands) (Bass 1998: 169).

Ionian Islands

Located further south in the Adriatic, the Ionian group comprises eight main islands (Fig. 4.57): Corfu, Paxos and Antipaxos, Lefkas, Kephalonia, Ithaka, Zakynthos, and Kythera, the last isolated from the rest and situated in the SE extremity of the Peloponnese. The islands are mountainous, with cliffs to the west, and lower slopes to the east, in the direction of the Greek mainland, with which the islands share geological and climatic characteristics. The islands have mainly limestone geology, with karstic phenomena, and high rainfall (Kourtessi-Philippakis 1999: 282). Cherry (1990) presented significant advances made on Kephallonia since the mid-1980s. Middle Palaeolithic material, dated ca. 50,000 years BP, was identified in the north of the island at Nea Skala (Kavvadias 1984), while the next known material mentioned by Cherry (1990: 173) was EBA. Cherry noted that Kephallonia, Zakynthos, and Ithaka formed a large landmass that was insular throughout the Pleistocene, lying at a distance of not more than ca. 20 km from the west coast of Greece (1990: 171). In Corfu, a Mesolithic site, Sidari, was also documented by Cherry (1990: 173), who pointed out that the island would not have been insular at the time. Two LN-EBA sites, Tzarantanou and Makrou in western Corfu (Lintovois 1983), were also mentioned by Cherry (1990: 173). For the rest of the Ionian islands, Cherry (1990: 171, 173) saw a pattern of Final Neolithic to Early Bronze Age colonisation, although he singled out the cave site of Evgiros (Choirospelia) in southern Lefkas for its production of MN-LN material (1990: 173).

The Ionian islands have witnessed interesting recent developments (Table 4.12). A volume published by Souyoudzoglou-Haywood (1999), although explicitly concerned with the Ionian Bronze and Iron Ages, contains useful information regarding archaeological investigation in these islands over the ten years previous to its publication. The author (1999: 6) mentions, together with the Palaeolithic material discovered by Sordinas (1969) on Corfu, another three Palaeolithic sites on the small Diapontia islands, NW of Corfu. She further notes that Sordinas (1969) also reported Levallois-Mousterian tools on a number of sites on Lefkas. Sidari, in Corfu, was excavated by Sordinas (1969), who also identified two EN levels (which Cherry [1990] did not discuss). The lowest is dated 5720±120 bc (=4830/4300 2σ cal. BC); the highest 5390±180 bc (4580/3800-3880 2σ cal. BC). The highest level contained pottery that has been related to the impressed wares of Macedonia, Yugoslavia, and Southern Italy (Weinberg 1970: 586, in Souyoudzoglou-Haywood 1999: 6).

Evidence for the Neolithic on Kephallonia is also very new, with sites found in the last decade: the caves of Drakaina (LNII or FN), Skala (in the south, where Palaeolithic material was also found), and Kokkolata-Kouroupata, which, according to Souyoudzoglou-Haywood (1999), may be LN (or FN) rather than EBA. On Lefkas, at Choirospelia, Souyoudzoglou-Haywood points out that the black-burnished pottery suggests contacts with the Peloponnesian Neolithic, while the matt painted and polychrome wares a possible northern, Dalmatian, connection (1999: 7). On Ithaka, Neolithic pottery has been identified at the Cave of Polis, while in Zakynthos Neolithic occupation awaits confirmation, although Sordinas (1970: 124) suggested a Mesolithic date for tools he collected in the SE of the peninsula of Vassilikos on Zakynthos (Souyoudzoglou-Haywood 1999: 7).

Another 1999 volume, this time by Kourtessi-Philippakis, also reviews discoveries from the Ionian islands, some fraught with controversy. The volume reviews claims for Moustero-Levalloisian industries, which have been identified on numerous sites on Corfu (Sordinas 1969), at Fiskardo on Kephallonia (Kavvadias 1984), at Yerakas, and in other sites in the interior at Zakynthos. The finds are important to the understanding of the first human occupation of the area, at a time, however, when some of the islands formed an extension of the mainland. Most are isolated finds, or their dating is unsupported by any contextual information (Kourtessi-Philippakis 1999: 284). The main points are summarised below.

During fieldwork in the early 1990s, Sorel identified lithic artefacts in the SE extremity of Zakynthos, in the Vassilikos peninsula, and located several open sites as a result (Kourtessi-Philippakis 1999: 284). Of these, the Yerakas site yielded a sidescraper and a Mousterian point; Aghios Nikolaos produced flake material made from local flint pebbles, as well as several cores (*ibid.*). Kourtessi-Philippakis noted that Aghios Nikolaos shows interesting parallels with the site of Nea Skala on Kephallonia, from both the geological and the archaeological points of view: both are found on terraces formed during the Tyrrhenian transgression (ca. 190-110 k BP) and display lithic industries dominated by small choppers (1999: 286). In SW Corfu, at Gardiki headland, near the Korission lagoon, a pebble tool (chopper) was located by geologists in a layer dated to the beginning of the Middle Pleistocene (ca. 750,000) (Kourtessi-Philippakis 1999: 283).

Further publications, by Dousougli (1999) and Zachos and Dousougli (2003), discuss in detail the Palaeolithic sites discovered on the island of Lefkas. Sordinas (1983) had already reported the discovery of Middle Palaeolithic material on the island, although systematic investigation began only in the late 1980s. The sites cluster especially in the Karyotes fan, while other sites are found at Cape Doukato (the southern tip of the Leukata peninsula in SW Lefkas), Englouvi (on a high plateau of Leivadi), and Tsoukalades. The sites identified are all open air and there are no radiocarbon dates: dating is based purely on typology and the temporal relation between the sites remains to be established (Dousougli 1999: 288; Zachos and Dosougli 2003: 21-23).

In conclusion, Palaeolithic material is attested from Kephallonia, Lefkas, Zakynthos, Corfu and neighbouring Diapontia islands; Mesolithic material is documented from Corfu and possibly Zakynthos; and Neolithic material is attested on Corfu (EN), Kephallonia (FN), Ithaka, Lefkas, and possibly Zakynthos. The earliest material found on Corfu and Lefkas subsequent to their insularisation is Neolithic in date and could represent either dry-shod occupation or recolonisation.

SOUTH-WESTERN AEGEAN ISLANDS

While Cherry (1990) confirmed the EBA colonisation horizon already noted in 1981 for the SW Aegean, Broodbank (1999a) signals two new instances of LN evidence (Fig. 4.58, Table 4.11 for general chronology and Table 4.13 for specific chronology). The EBA horizon recorded by Cherry (1990), based on Hope Simpson and Dickinson's (1979) work, is confirmed by finds on Idra, Dokos and Spetses by Kyrou (1990), possibly too late for Cherry (1990) to note, but picked up by Broodbank (1999a: 18). In the early 1990s, no early material had yet been identified on Salamis. Late Neolithic material has now been identified, although Salamis was possibly becoming insular at this time, therefore this material might indicate dry-shod colonisation

(Broodbank 1999a: 22). Should this be the case, the EBA colonisation horizon of Poros may reflect the lack of research there since the late 1970s.

THE CYCLADES

With the exception of the indirect evidence of Melian obsidian found in the latest Upper Palaeolithic levels at Franchthi Cave on the Greek mainland, the earliest known direct evidence for human presence on the Cyclades (Fig. 4.59) is documented at the open site of Maroulas on the island of Kythnos (Sampson 2002). Dates from the site came as 8068-7688/8263-7911 cal. BC, 6230-6410/7000-6200 and 6230-5990/6400-5800 cal. BC, thus spanning the Late Mesolithic-Early Neolithic transition (note that Kythnos was insular) (Trantalidou 2004). The excavation revealed a series of human burials in rock-cut or cist tombs (Sampson 2002), and some habitation structures (a house floor and some circular constructions), which, according to Sampson (2002), show similarities with the Pre-Ceramic phase of Shillourokambos on Cyprus. Environmental analysis at the site revealed the presence of land and marine snails, tunny, and several other fish species (Trantalidou 2004). Apart from this isolated early site, the earliest known evidence for the human occupation of the Cyclades dates to the Late Neolithic, which marks a departure from Cherry's (1990) analysis of the chronology for this archipelago.

In 1990, Cherry confirmed that the 1981 pattern was still valid for the Cyclades: data in the late 1970s indicated that less than 20% of the islands showed signs of settlement before the start of the EBA, but over 70% had been colonised by its end (1990: 164). Nevertheless, Cherry could not help noting a new development that somewhat modified this generalisation: this was 'the discovery of a small, but growing, number of sites providing additional evidence for the use or occupation of some islands in the later part of the Neolithic' (1990: 164). Research in the past ten years has confirmed this trend. Table 4.14 tabulates data from Cherry (1981, 1990) and Broodbank (1999a) (please note that dates in Broodbank 1999a are Neolithic onwards).

Broodbank (1999a: 18) considered a sample of 24 Cycladic islands (criterion is minimum size, set at 3 sq. km): eight of these have produced LN/FN material (against Cherry's four - 1981: 55) (see Table 4.14); two are FN/EBA; seven have EBA material as the earliest (as opposed to the 20 listed in Cherry, *ibid.*), while for the remaining seven there are no available data. Broodbank commented on the increasing number of Late to Final Neolithic settlements (confirmed or probable) identified in the Cyclades since the early 1980s (1999a: 15). Of the twenty islands with earliest material originally identified as EBA, only seven remain ten years later; on all the others LN/FN evidence has been discovered since, such as at the site of Phtelia on Mykonos (Sampson 2002) and at Strophylas on Andros (Televantou 2004). The number of sites with Neolithic material has doubled, with Broodbank's (1999a) Cycladic sample containing a roughly even spread of islands with LN/FN (8), EBA (7) or no data at all (7).

SOUTH-EASTERN AEGEAN ISLANDS

The south-eastern Aegean witnessed dramatic developments between the early 1980s and 1990s (Cherry 1990: 168) (see Fig. 4.60 and Table 4.15). In the 1980s, material of pre-EBA date had been published only from Kalymnos, Kos and Rhodes, and the lack of settlement on Karpathos and Ikaria (both large and within easy reach) had been singled out by Cherry (1981: 52). By the early 1990s, 80 early prehistoric sites (broadly LN-FN) were known in the Dodecanese islands, and new developments were recorded for Karpathos, Kasos and Saros, Rhodes, Giali, Alimnia, and Leros (Cherry 1990: 170). Cherry concluded that 'many of the islands of the south-east Aegean, both large and small, seem to have been settled during the later stages of the Neolithic' (*ibid.*). This observation is confirmed by Broodbank (1999a), with little subsequent development in the last decade.

NORTH-EASTERN AEGEAN ISLANDS AND NORTHERN SPORADHES

The trend of earlier colonisation dates is confirmed in the north-eastern Aegean (Fig. 4.61, Table 4.16) and Northern Sporadhes (Table 4.17) and.

Palaeolithic locations have been identified on Thasos, Halonissos, Kyra Panagia, Skyros (Cherry 1990), and on Lesbos (Broodbank, pers. comm.). For most of these, this represents dry-shod colonisation at a time when the islands belonged to an extensive emerged coastal plain (van Andel and Shackleton 1982). A late phase of the Early Neolithic is attested on Kyra Panagia (Cherry 1990: 167) and slightly earlier on Skyros (either dry-shod settlement or subsequent recolonisation). Lemnos, Thasos, and Samothrace have Neolithic settlements, as well as EBA sites (Cherry 1990: 168).

A major discovery was the excavation of Mesolithic layers under the EN, MN, and LN levels at the Cyclops cave on the island of Gioura (Northern Sporadhes), which is ca. 20 sq. km in size and 4 km from Kyra Panagia (and the furthest from the mainland in its group) (Sampson 1996). Sampson (1996, 1998) also reported similar and perhaps earlier finds on neighbouring islets (Broodbank 1999a: 20; Davis *et al.* 2001: 79). The dated sequence from the Cyclops cave started at 8626-8323/8610-8299/8606-8316/8690-8290 cal. BC and lasted to ca. 4000 cal. BC (Trantalidou 2004). Gioura was insular at the time of this occupation, with the sea level 60-40 m lower than the present day (Broodbank 1999a: 16; Sampson 2001: 61). Finds in the cave point to fishing-related activities (fish processing was a main activity inside the cave), with tools and the remains of 30 marine species represented in the record (thousands of fish, shellfish and mollusc remains), but also to the hunting of marine mammals, bird catching (whose seasonality gives an important indication of when the cave might have been occupied, possibly in late spring), and the use of wild plant resources (Trantalidou 2004). Recently, Fiedel and Anthony (2003: 154-5) have commented on the fact that the lithic industry from the cave (consisting mainly of trapezoidal and lunate microliths) is different from that found at contemporaneous Mesolithic assemblages from mainland Greek sites, and bears more similarities with epi-Palaeolithic tools from south-western Anatolia (e.g. Antalya).

CRETE

Cherry's comment on the fact that our understanding of the colonisation of Crete has hardly changed since the early 1970s (1990: 158) still applies. Claims for a pre-Neolithic or even Palaeolithic human presence on Crete were discarded by Cherry (1981: 43) as unreliable, and in his 1990 update further claims that had been made in the interim were also dismissed. These included a possible Mesolithic site in the Samaria Gorge (western Crete) and the report of a human skeleton dated, on the basis of palynological data, to the Middle Würm period (Cherry 1990: 158) (Figs. 4.62-4.63). Broodbank (1999a: 20) points out that the possibility that hunter-gatherers visited Crete (Rackham and Moody 1996: 1-2; Runnels 1995: 728) and the causes of extinction of Crete's endemic fauna (Cherry 1990: 163; Lax and Strasser 1992; Reese 1996) are still the focus of lively debate.

The earliest known Neolithic site is at Knossos, which is regarded as a clear example of settlement by Neolithic farmers because the domestic species found here have no local wild progenitors (Evans 1971a). The small size of the site suggested a founding population of fewer than 100 individuals (Evans 1971a: 116), or a dozen families at the most (Cherry 1985: 24). Evans (1971a) envisaged farmers migrating to Crete bringing with them the full Anatolian-Balkan package (sheep, goats, pigs, cattle, dogs, cereals, and legumes). Broodbank and Strasser saw this as possibly 'one of the earliest successful maritime transfers of a full farming economy', indicating a 'purposive, planned and comparatively long-range colonisation' (1991: 234).

Knossos has produced 19 radiocarbon dates for the Neolithic, which are reasonably consistent. The earliest, from aceramic layer X, is dated 7th millennium cal. BC. Cherry (1990: 161) believed this was contemporary with the earliest Cypriot sites (the earliest assumed to be Khirokitia, although he admitted that Kalavasos *Tenta* could be earlier). But in contrast to Cyprus, for which he was able to list 20 known sites (1990: 155), Cherry noted that no other aceramic sites had been identified in Crete apart from Knossos, and that Early Neolithic sites were overall rare (Cherry 1985: 24; 1990: 161) until the 4th millennium cal. BC (Cherry 1990: 163). Settlement on the island increased in the Late and Final Neolithic, by which time Knossos had increased from its original 0.35 ha in the aceramic phase to an estimated 4-5 ha (Cherry 1990: 161).

CYPRUS

In the early 1990s, Cherry (1990: 148, 150-1) reviewed significant advances regarding the earliest colonisation of Cyprus (Sheen 1981; Kypri 1985; Todd 1986; Fox 1987, 1988). The excavation of the rock-shelter site at Akrotiri-*Aetokremnos*, on the south coast of the Akrotiri peninsula, was the most important of these discoveries, as it proved for the first time that Cyprus had been occupied before the Neolithic (Simmons 1989, 1991, 1999; Held 1989b: 39-63) (Figs. 4.64-4.65). The number of radiocarbon dates from the sites grew from 15 (Cherry 1990: 153) to 31 in a ten-year period (Simmons 1999: 195-8). The dates indicate that the site was occupied for a 'short time' during the 10th millennium cal. BC (dates span 9702-10005 cal. BC 1 σ) (Simmons 1999: 208). An average date of 9825 cal. BC was obtained from the 26 most reliable samples (*ibid.*).

No convincing evidence for Palaeolithic humans has been found on Cyprus, and Akrotiri-*Aetokremnos* is therefore the earliest Cypriot site known so far, providing, according to many, the earliest secure evidence for human occupation on any island in the Mediterranean (Simmons 1989, 1991, 1999: 18-21; Cherry 1990: 151; Peltenburg *et al.* 2001: 37) (N.B. excluding Sicily and the controversial early dates from Corbeddu Cave, Sardinia). According to the excavators, the *Aetokremnos* rock-shelter yielded *in situ* stratified cultural deposits (Held 1989b; Simmons 1999: 44, 93): these included a midden area (with pits) and several 'casual hearths' (Simmons 1999: 95), associated with a huge faunal assemblage of almost 300,000 remains. Of this extremely rich repertoire, ca. 250,000 belonged to the species *Phanourios minutus*, pigmy hippopotamus, and 332 were *Elephas cypriotes*, pigmy elephant (Simmons 1999: 153, 161). Other species included *Sus scrofa* (pig), *Dama mesopotamica* (fallow deer), *Genetta plesictoides* (a type of genet), *Mus macedonicus* (mouse), as well as terrestrial turtle (tortoise) (Simmons 1999: 164-9, 187). More than 70,000 marine shells were found, but only one fish bone was retrieved from the whole site (Simmons 1999: 187-8). In addition, the remains of several bird species were excavated, and their seasonality patterns were used to show that the site was probably occupied throughout the entire year (Simmons 1999: 181). Although flotation samples were retrieved during excavation for pollen, the botanical analysis of the remains yielded no meaningful results, with only *Pinus* and another unspecified conifer identified (Simmons 1999: 229).

According to Simmons, 'the association of *Phanourios* and *Elephas* with cultural remains provides a rare example of human coexistence with Pleistocene faunal species in an island context' (1999: 43, 324). Binford (2000), however, has dismissed Simmons's claims that the bone assemblage at the rock-shelter proves human-induced faunal extinction as 'puzzling'. He argues that Simmons has systematically ignored evidence that would challenge his views, such as the fact that none of the bones display cut-marks or signs of breakage for marrow extraction (Binford 2000: 771). Binford goes on to show, through simple correlation analysis, that the pigmy hippopotamus bones are inversely correlated with the lithic remains, while there is positive correlation between the lithics and the bird remains, eggshells, marine shells, charcoal, and introduced pebbles and cobbles, all of which are found in Level 2 (i.e. the occupational level with the cultural features). Furthermore, Binford highlights the fact that 'no documented features originate within the bone bed', thus excluding any human involvement in the accumulation of the bones (2000: 771). In the light of these claims, it remains unclear whether the inhabitants of the rock-shelter actually co-existed with these endemic species. However, the site does provide evidence of a very early human presence on the island, mainly from the sequence of radiocarbon dates derived from stratified cultural deposits.

Cherry (1990: 152), who supported Simmons's view of a human-induced faunal extinction, noted that it was unclear whether Akrotiri-*Aetokremnos* was a specialised processing site, or an actual occupation site, which in any case he took to be sporadic. Simmons (1999) saw Akrotiri-*Aetokremnos* as 'short lived and *ultimately unsuccessful*, having little impact on future development of the island' (1999: 43, emphasis added). For Held

(1989a) and Peltenburg *et al.* the occupants of the rock shelter represent 'utilisation or exploration rather than colonisation' of the island (i.e. permanent settlement) (2000: 851-852). Held (1992: 19-20) and Simmons (1999: 323) have claimed that this phase showed no links to the Khirokitian culture about three millennia later (Knapp *et al.* 1994: 381), and argued in favour of a chronological gap from ca. 8500 to 7000/6500 cal. BC (Peltenburg *et al.* 2002: 62).

Cherry (1990: 154) also believed, on the basis of the long gap between them, that the first humans on Cyprus (the *Aetokremnos* community) could not be related in any way to the aceramic Neolithic (Khirokitia) farmers. He argued that the lack of sites in the period after *Aetokremnos* and before the aceramic Neolithic could be interpreted in different ways (either as evidence that the colonists died out or that they abandoned the island after seriously depleting its fauna) and that, whatever the case, the most likely scenario was one of cultural involution and subsequent re-colonisation by a new group (*ibid.*). Cherry, however, also noted that the other apparent gap in the island's archaeological record, between the aceramic Neolithic (Khirokitia culture) and the ceramic Neolithic (Sotira culture), could indicate an inability to recognise sites, or a temporary decrease in settlement, rather than actual abandonment (1985: 25; 1990: 157). Nonetheless, since the possibility of abandonment could not be entirely excluded, he hypothesised potentially three colonisation events for Cyprus, which was 'wholly unparalleled on any of the other large Mediterranean islands' (Cherry 1990: 157).

The 1990s have been extremely fruitful in shedding light on these issues. Six new aceramic Neolithic sites have recently come to light (Table 4.18) and, as a result, data from previous excavations that appeared unexpectedly 'old' have been reconsidered, such as Kalavasos-*Tenta* (Todd 1987), Akanthou-*Arkosyko*, Ayia Varvara-*Asprokremnos*, and Troulli I (Peltenburg *et al.* 2001: 42, 2002: 62). In the mid-1980s, Todd published a series of radiocarbon dates from Aceramic Neolithic deposits from Kalavasos-*Tenta*: amongst these was an early date (tenth mill. BP, or late 9th mill. cal. BC) (1987: 173-8). The site appeared to be earlier than Khirokitia (Cyprus's eponymous Neolithic site and the earliest then known), but Todd viewed the results with great caution (Cherry 1990: 161; Peltenburg *et al.*

2001: 37). In the light of the new discoveries, Peltenburg *et al.* (2001: 41) suggest that Todd's original dating should be reconsidered, and that the radiocarbon dates and the stratigraphy indicate that Kalavasos-*Tenta* is partly contemporary with the newly discovered sites (Kissonerga-*Mylouthkia* 1B and *Shillourokambos* Middle Phase).

The earliest of these new sites, Kissonerga-*Mylouthkia* and Parekklisha-*Shillourokambos*, were founded in the second half of the 9th millennium cal. BC and span a period of ca. 1500 years (Peltenburg *et al.* 2000: 844, 2001: 40). Peltenburg has suggested that Mylouthkia 1A and Shillourokambos Early Phase A must be close to original landfalls, both temporally and spatially (2000: 852), and that the location of Mylouthkia 1A, in the south-west of the island, 'should prompt a reconsideration of colonisation paths and dispersal rates' (see Held 1992: 120, 126) (*ibid.*). The discovery of these new aceramic sites has resulted in a rewriting of Cypriot prehistory: collectively, the sites provide support for the 'antecedent development' hypothesis for Cyprus's Khirokitian culture. According to Peltenburg *et al.*, they provide evidence that immigrants from the mainland (who may have come either from west Syria [Peltenburg *et al.* 2001: 37] or the Upper/Middle Euphrates river area [Guilaine *et al.* 2000]) colonised Cyprus much earlier than previously believed (Peltenburg *et al.* 2002: 61). Peltenburg *et al.* believed that the early aceramic sites represented 'the elusive ancestry for the Khirokitian and an extension of the Levantine mainland Pre-Pottery Neolithic' (2000: 844), thus eliminating a chronological gap that had been present in Cypriot prehistory since the 1980s (Peltenburg *et al.* 2003: 85, 87). The antecedent development hypothesis is supported by the fact that all the species previously attested from the Khirokitia phase have been found at these early aceramic sites, indicating that they were present on Cyprus as early as the end of the 9th millennium cal. BC (Guilaine *et al.* 2000). This has the striking implication that domesticated animals (sheep and goat) were imported to the island more than a thousand years earlier than until recently believed, and that cattle (which were present at Shillourokambos but not at Mylouthkia) were also a very early introduction (Peltenburg *et al.* 2001: 46). These facts place these amongst the 'earliest known anthropogenic introduction of animals to a Mediterranean island' (Vigne *et al.* 2000: 96; see Chapter 2).

The sites also displayed a high degree of cultural similarity to that of the south-western Asiatic mainland. These included parallels in the chipped stone tradition, in the manufacture of mudbricks, and in the domestic architecture (Peltenburg *et al.* 2002), as well as in the symbolic realm, with parallels in the maceheads, engraved pebbles, figurative artwork, and in skull treatment (Peltenburg *et al.* 2000: 845, 2001: 54). Another important parallel with the mainland is the tradition of well digging. Five water wells were excavated at Kissonerga-*Mylouthkia*, and dated between the late 9th and 8th millennium cal. BC, which means that they are among the earliest known wells in the world (*ibid.*). Peltenburg *et al.* have defined well digging as 'a particular adaptive strategy for sustainable sedentism', a specialised activity essential to island life (2001: 39, 47, 48; 2003: 89). Although springs are present on the island, the wells are likely to have offered a buffer against severe drought (Peltenburg *et al.* 2003: 89, 92). Vigne *et al.* have claimed that all these parallels imply maintained contacts with the Levantine mainland after the original migration (2000: 83, 98). Peltenburg *et al.* support this view, and also point out that both the arrowheads (Bar-Yosef and Belfer-Cohen 1989: 64) and the blade-based lithic industry suggest the early transmission of 'know-how' to the island from the north-Levant mainland (2001: 51), and that this is particularly evident at Mylouthkia 1 (Peltenburg *et al.* 2002: 78). The Cypriot farmers started to adapt their lithic industry (adopted from the mainland) to their environment only about a thousand years after they had reached the island (around the late 7th mill. cal. BC) (evident from Mylouthkia 1B and Shillourokambos Middle Phase) (Peltenburg *et al.* 2001: 52).

CONCLUSIONS

The review of colonisation data in this chapter draws upon island projects that span several years of archaeological research, and inevitably the results reflect different research agendas. At the same time, the data themselves range from the end of the Pleistocene to the Iron Age, i.e. from the first time that human presence is recorded on any island to the time when it is documented on most of them. Chronological accuracy is variable between areas, with some colonisation sequences supported by radiocarbon or AMS dating (e.g. the Balearics and Sardinia), others by typological seriation (e.g. the Tremiti islands), and others by a combination of both (e.g. Lipari). However, relative chronology in certain areas, especially the Aegean, is now much better established than it was in the early 1990s (see Davis *et al.* 2001). Clearly, fine chronological resolution is critical, but so are the reliability of the sample contexts from which the dates are taken and their clear association to human activity, which is not always straightforward.

Because of the eclectic nature of past research, this study could not always offer a full picture of colonisation processes in discrete areas (e.g. the North African islands). However, individual sections from different areas and periods contributed vital pieces of information. In spite of these difficulties, systematising the data in the light of these strengths and weaknesses is a valid avenue of enquiry and offers a powerful research tool for investigating colonisation. Differential exploration still affects studies of Mediterranean islands, with those in the east still favoured by a longer tradition of island survey than in the west. However, this picture is increasingly changing, with the number of islands studied in the west almost doubling in the past twenty years. Even if not all islands have received the same amount of research (varying from intensive survey, or excavation of multi-period sites, to reports of finds awaiting further investigation), all areas in the Mediterranean are now covered to some extent. The data clearly indicate that colonisation involved a variety of activities, which will be used in the following chapter to explore colonisation from a quantitative and qualitative point of view.

A couple of general points should be made based on the review, before specific questions are addressed in the next chapter. There is still a great deal of controversy surrounding the timing of certain colonisation events, e.g. in the Balearics and (to a lesser extent) Sardinia. However, overall the data indicate that extensive colonisation of the islands took place long after the settlement of adjacent mainlands. It is striking how little consensus there still is on what is actually meant by 'successful' colonisation, and on what the roles of mobility and abandonment were in such processes. The increasing evidence of human presence on Mediterranean islands before the Neolithic is refining this concept, highlighting the fact that colonisation involves several different and sometimes related activities (not always aimed at laying the foundations of long-lived settlement).

CHAPTER 5

BUILDING A NEW APPROACH TO ISLAND COLONISATION

The Pan Mediterranean Record. New Data, New Patterns?

Many models of island colonisation draw upon the pioneering work of John Cherry (1981, 1990), which provides the starting point for this section. In 1981, Cherry created a plot of cumulative percentage of the islands in the eastern and western Mediterranean with evidence of occupation by a given millennium bc (uncalibrated) (Cherry 1981: 62) (Fig. 5.1). The graph depicted colonisation as a linear or cumulative process (details of which were discussed in Chapter 3). In 1990, Cherry synthesised some significant developments that had taken place since 1981, but did not update the graph in the light of these new discoveries, with the result that his colonisation model is now over twenty years out of date.

Cherry's work was so influential that in 1996 Vigne produced another graph, which also portrays colonisation as a linear trajectory (Fig. 5.2). Unfortunately, no table of data accompanied this plot. The sample size is also unclear (although it appears that absolute numbers rather than percentages are represented on the y axis). In a footnote, Vigne briefly mentions that his main sources are still the two Cherry articles (1981, 1990). In the same year, Patton presented a pan-Mediterranean graph of island colonisation showing percentages of islands colonised per millennium cal. BC (largely based on Cherry [1990] data) according to three visibility categories (rather than to the western and eastern Mediterranean distinction) (Fig. 5.3). This graph indicates that the timing of colonisation did not follow biogeographical predictions based on the islands' visibility, since islands in category B were colonised before those in category A (see Chapter 3). Patton hypothesised that this might imply that the rate of colonisation did not correspond to the rate of discovery (1996: 54-5). The two cumulative plots compiled by Vigne (1996) and Patton (1996) give a good indication of how the model generated by Cherry has become rooted and largely unquestioned over the years.

Methodology

Cherry has recently claimed that biogeographical and cultural variables can provide a useful category for the study of islands in the Mediterranean, leading in turn to useful worldwide correlations being drawn (2004: 244). The data analysis in this chapter has been designed in such a vein and uses spatial and cultural variables in order to extrapolate quantitative and qualitative observations concerning the earliest colonisation of the islands.

The quantitative analysis focuses on basic spatial parameters discussed in Chapter 3 and has been designed with the aim of testing biogeographical reasoning on an up-to-date island dataset (the analysis is carried out on all the islands in the database: Tables 5.1 and 5.2). The qualitative analysis, on the other hand, is an attempt to identify cultural variables for comparative study and could not be carried out on the whole database but focuses instead on a selection of islands. The next step in the qualitative analysis, beyond the scope of the current study, would be the systematic testing of the effects caused by such cultural variables through a numeric approach to be devised purposely. In this study, sites were selected as potentially providing evidence for specific cultural features (diagnostics or correlates) or as illustrating particular cultural processes, namely island visitation/utilisation, permanent settlement, and establishment.

Initially, the quantitative analysis consists in retesting the graphs that Cherry produced in 1981. This is carried out because there is a need to update the original graphs in the light of new archaeological discoveries discussed in Chapter 4. The approach designed by Cherry is considered valid and useful and therefore it has been replicated through the creation of colonisation scatterplots for the western and eastern Mediterranean islands (cf. Cherry 1981: 50-51) and of a cumulative colonisation plot (cf. Cherry 1981: 62). In addition to these, variations of the original tests and further statistical tests are presented in this chapter. This study presents a non-cumulative colonisation chart as an alternative way of viewing the same colonisation data but allowing one to compare rates of island colonisation per period and area. These rates are explored for the whole Mediterranean and subsequently for individual regions, which are then grouped according to criteria discussed in due course, in order to compare regional colonisation patterns. Owing to constraints on data availability, initial colonisation data have been used predominantly in this chapter to compile the graphs (with the exception of the Spanish and Aeolian Islands, where occupation charts are also presented and discussed). Earliest colonisation data were obtainable for all 145 islands, whereas long-term occupation data are less available (because of differential archaeological investigation), and will be discussed through case studies in Chapter 7.

Another series of graphs explores different island-mainland configurations, by grouping islands on the basis of different combinations of spatial variables: islands have been ascribed to different categories based on their size and distance to the nearest mainland. In these graphs, 'near' is defined as being less than 20 km from the nearest mainland (or a day of voyaging using a canoe, see Chapter 3) and 'large' as being more than 50 sq. km. Other types of analyses that could have been carried out for the whole database but were not - owing to time constraints - include the study of inter-island configuration or an investigation of the so-called 'stepping-stone effect'. This would involve running the analysis in a similar way as described above but by grouping islands based on their distance to the nearest other island rather than the mainland. The potential for this kind of study is explored in part in this chapter, through the application of biogeographical analysis to the Aeolian Islands. These islands, which have been the object of meticulous investigation by archaeologists for the past 50 years, provide a reliable backdrop for examining the patterns of exploration and settlement, which are then compared to those noted for the Dalmatian Islands (another well-studied island group). The potential role of inter-island configuration is also discussed through further case studies in Chapter 7, where inter-island distance is investigated as a potential factor affecting abandonment.

The qualitative assessment is of necessity more descriptive in nature than the quantitative analysis described above. Different variables require different kinds of analyses, and here sites are described in order to assess the potential of different material assemblages as diagnostics or correlates for cultural activities (such as exploration, utilisation, and settlement). An initial assessment is also made of the role of resources, which will be explored further in Chapter 7, where the presence or not of resources in general and of obsidian in particular is analysed in detail. This section, on qualitative aspects of colonisation, is aimed at illustrating different kinds of colonisation activities and strategies for using islands (ranging from seasonal resource acquisition to permanent inhabitation) in different islands and periods. It presents colonisation as a broad category of activities and opposes a teleological view of colonisation, in which such activities are viewed as necessary steps towards settlement or as evidence of failed colonisation when settlement does not occur. Instead, it is argued that such unilinear views of colonisation are detrimental to a correct understanding of colonisation as a whole and that links between these colonisation activities should be substantiated archaeologically (this point is followed up in Chapter 7). The activities are investigated through the description and comparison of selected island sites. Colonies are seen as 'activity-sites', with settlement and resource procurement both qualifying as activities. The sites are chosen as illustrating island colonisation in pre-Neolithic and post-Neolithic contexts and as showing parallels and differences between these and Neolithic colonisation activities, specifically their settlement, which - as we have already seen and as we shall see in the following quantitative analysis section - is the better known or more frequently acknowledged of colonisations.

QUANTITATIVE ASPECTS OF ISLAND COLONISATION

As an initial stage in this chapter, the graphs originally produced by Cherry (1981) have been amended with the data discussed in the sector-by-sector analysis presented in the previous chapter. As a subsequent step, the revised data were used to create regional graphs of earliest colonisation to match against the pan-Mediterranean plot. Cherry's dataset was predominantly eastern Mediterranean (ca. 60 islands investigated in the eastern Mediterranean and 35 in the western Mediterranean). The database in the present review includes 145 islands, 83 in the eastern Mediterranean and 62 in the western Mediterranean. The sample of western Mediterranean islands has increased because it incorporates data from the North African islands (Bates 1914; Vuillemot 1954; Balout 1955; Souville 1958; Bourain *et al.* 1995) and the central Adriatic islands (Gaffney *et al.* 1997, 2000; Bass 1998). The revised earliest colonisation plot (Fig. 5.4) is the result of this critical update. A further colonisation plot at the end of the review shows the islands subdivided into three groups (western, central, and eastern Mediterranean), with the Adriatic and Ionian islands incorporated in the central Mediterranean (Fig. 5.63), and will be discussed in due course.

Overall, the revised cumulative plot confirms the general trends noted by Cherry: islands were colonised incrementally, apparently confirming a gradual and continuous 'infilling' of available land, which, generally speaking, was faster in the western than in the eastern Mediterranean, at least until the late 4th-early 3rd millennium cal. BC. The most notable difference from Cherry's original graph (apart from the fact that the temporal 'origins' of colonisation have been pushed back in both east and west) is the reduction in the colonisation time lag first noticed between the two areas (between the 7th/6th and the early 3rd millennia cal. BC), which is mainly the result of a set of earlier dates that have become available from the eastern Mediterranean (especially the Aegean).

In the west, Cherry (1981) had noticed a lack of spatial patterning in the islands being colonised. When more recent survey data are brought into the picture, some size/distance related observations can be made, and their relevance will be discussed. The data summarised in Fig. 5.5 (see also Table 5.1) shows that, excluding the islands that were colonised at low sea levels, when land bridges probably existed (e.g. Sicily), the first western islands to be colonised are the larger islands (Sardinia and Corsica). There is evidence of human presence on the island of San Domino (Tremiti) from the 7th or perhaps 6th millennium cal. BC, when the other Tremiti islands were perhaps frequented (this chronology depends on traditional pottery typology, Early Impressed Ware). The Tremiti islands are very small (in the order of 1 sq km) and less than 30 km away from the nearest mainland (SE Italy). Colonisers however also ventured further away at this time, up to ca. 130 km in the case of Palagruža (although this journey could be broken up into two 50 km stretches from either the Italian or Croatian side, via Pianosa or

Susač). All the other islands colonised during this millennium lie less than 80 km away from the nearest mainland and most belong in the 10-100 sq km bracket (with a few smaller and larger exceptions). The islands colonised in the 5th millennium are generally close to the nearest mainland (less than 60 km), with one remote exception (Lampedusa). A range of sizes is represented (ca. <1-600 sq km). In the 4th millennium, the islands are all smaller than 100 sq km and less than 40 km away from the nearest mainlands. In the 3rd millennium most islands colonised are very small (smaller than 10 sq km), and between 10 and 100 km from the nearest mainland (with the notable exception of the two Balearics). A number of islands were colonised in the 2nd and the 1st millennia, when there appears to be no spatial patterning in the islands occupied, although the islands are generally small (less than 20 km sq) and, particularly in the 1st millennium, some lie close to larger islands previously occupied (e.g. Comino, Kopiste, Conejera, Cabrera), perhaps reflecting the filling-up of remaining empty space or possibly requirements linked to specific functional uses (e.g. ritual spaces, cf. Palagruža).

For the eastern Mediterranean, some of the overall processes and patterns first noted by Cherry can still be recognised, but the new data indicate a much stronger increase in colonisation after the 6th millennium (particularly in the 5th and 4th mill.) than previously seen (compare Figs. 5.1 and 5.4). Evidence from the eastern Mediterranean has been summarised in Fig. 5.6 (which should be viewed with Table 5.2). The earliest occupation is documented on the largest of the islands, Cyprus (in the 10th mill. cal. BC, at Akrotiri-*Aetokremnos* – although it became more permanent in the 9th). In the 8th millennium, Gioura and Kythnos (two small islands in the Northern Sporadhes and Cyclades respectively) were also occupied for the first time. These may not be isolated instances, as further evidence awaiting systematic investigation has been found on several islets around Gioura (Davis *et al.* 2001: 79). In the 7th millennium cal. BC, and the 6th in particular, a few larger islands were colonised, all of which lie less than 60 km from the nearest mainland apart from Crete, which is further away (see Chapter 3, for discussion on purposive colonisation). Neolithic colonisation in the 5th millennium seems to be all-pervasive, with islands colonised regardless of distance (up to 180 km from the nearest mainland, e.g. Thera, which is accessible via other islands). The same pattern holds roughly for the 4th millennium (e.g. Gavdos, which is close to Crete), while for the 3rd and 2nd millennia, most islands colonised fall below the 100 sq km threshold, with two exceptions (Imbros and Tinos), and again distance appears not to be a hindrance to their colonisation (up to ca. 150 km away via intervening stepping-stone islands). There is little spatial patterning of note for the 1st millennium, but the islands colonised are at the lower end of the size scale.

Some interesting conclusions can be made based on the revised colonisation graphs (Fig. 5.4, 5.5, 5.6):

1. There is increasing evidence for pre-Neolithic occupation of islands (Cherry's plot started with the 7th mill. cal. BC, Vigne's with the 8th, and Patton's with the 10th). Cyprus is the most notable case, but some small (true) islands in the Adriatic and the northern Aegean were occupied as early as the Mesolithic. This earlier evidence has become available also as a result of the fact that calibration curves now reach further back.

2. Overall, island colonisation in the western Mediterranean took place at a steadier and faster pace than in the eastern Mediterranean, at least initially, though the time lag noticed by Cherry in 1981 has been considerably reduced, with colonisation in the east following that in the west closely in the Middle to Late Neolithic and surpassing it during the Final Neolithic-Early Bronze Age transition.

3. There is a higher number of islands colonised in the Early and Middle Neolithic, or between the 7th and 4th millennia, than previously seen. The Neolithic is overall the key period for island colonisation.

4. Overall, spatial patterning appears to be more prominent in the west than in the east. This may be due to geographical differences already noted by Cherry (1981: 63) (e.g. large islands in the west acting as 'mainlands').

Cumulative vs. Non-cumulative Colonisation Plots

Two main issues emerge from the analysis of Cherry's cumulative plot: one conceptual, the other practical. Cherry conceived of island colonisation in terms of permanent settlement (1981: 49). Certain types of evidence, especially surface lithic finds, were discounted, since they proved human presence but not settlement (Cherry 1981: 48). Considering that it was only with the Neolithic and the Bronze Age that he could identify archaeological correlates he felt could be safely linked to colonisation, Cherry claimed that island colonisation was on the whole a product of such phases (*ibid.*).

From a practical point of view, cumulative curves are generally used for comparing datasets, but they can be misleading. In the case of Cherry's (1981) plot, there are two problems. The first is that direct comparison between the two datasets for the eastern and western Mediterranean respectively is made difficult by the fact that there are twice as many eastern islands as western ones in the sample he used. This problem has been reduced in the revised cumulative plot by the rise in the number of western islands for which data are currently available. The second problem concerns the choice of statistical rendition itself. Cumulative plots (both Cherry's and the revised one) count how many islands are colonised at least once during each millennium, and then add this number to those colonised during the preceding millennium. The plots are not 'wrong' (they do what they say they do, i.e. they accumulate), but they do portray, perhaps inadvertently, a false sense of long-term continuity, as they fail to incorporate abandonment.

Patton's 1996 review marked an initial departure from Cherry's cumulative approach by presenting a histogram of colonisation data (Fig. 5.7), which he used to identify distinct waves of colonisation (see Chapter 3) (Patton 1996: 59, 62). This was an important move away from the prevailing representation of colonisation, which until then had been cumulative or linear. However, Patton used the graph only to make some very general points about pan-Mediterranean patterns of colonisation and did not explore the implications of his observations on a regional scale. In this section, the idea of a non-linear, non-cumulative plot is developed further, as it has the potential to illustrate variations at a micro-scale to offer as a counterpart to both eastern vs. western (Cherry 1981) and pan-Mediterranean (Patton 1996) patterns.

Unlike cumulative plots, non-cumulative plots (Fig. 5.8) do not add the number of islands colonised in the previous millennium to the following, but only account for how many *new* colonisation events take place during each millennium (the data are represented graphically as a bar chart rather than a curve). These new colonisation events relate to *first-time* colonisation. Non-cumulative plots allow us to compare rates of colonisation between millennia and to identify distinct waves of colonisation. For example, Fig. 5.8 (which shows only first colonisation) indicates that, as far as we know, a higher percentage of islands was colonised in the 8th than in the 2nd mill. cal. BC western Mediterranean. The colonisation pattern for the eastern Mediterranean displays two distinct peaks (one during the 5th and the other during the 3rd mill. cal. BC). In the western Mediterranean, there is also a peak in the 5th millennium and a smaller colonisation wave in the 1st.

One of the aims of this chapter is to establish whether biogeographical variables are prominent in the colonisation of the islands as seen from the graphs. To this end, the evidence so far discussed is arranged in a series of graphs aimed at exploring the roles played by distance and size. Figs. 5.9 and 5.10 show how many islands were colonised in each millennium in the western and eastern Mediterranean respectively, based on separate distance groups. Fig. 5.9 shows that, in the west, distance was not a prominent factor overall, with far-away islands colonised both in early (8th-6th mill. cal. BC) and late (3rd-1st mill. cal. BC) periods. In the east (Fig. 5.10), distance appears more prominent, with only Crete, amongst the islands with distance to mainland higher than 100 km, colonised before the 6th millennium. Most western islands colonised in the 5th millennium are close to the mainland (<20 km) (Fig. 5.9), whereas in the east, this number is balanced out by a similar number of islands colonised that lie over 20 km away (Fig. 5.10). The highest number of distant islands (>100 km) was colonised in the eastern Mediterranean in the 3rd millennium (Early Bronze Age), usually via stepping-stone islands (Figs. 5.10 and 5.18).

Turning to size, it emerges that, in the west (Fig. 5.11) small islands (1-10 sq km) were colonised at different times, mainly in the 5th millennium (when we saw that most islands targeted are also <20 km away) (Fig. 5.9), whereas no large ones (>50 sq km) were colonised in the 4th millennium and only a couple in the 5th. In the east, on the other hand, most larger islands (> 50 sq km) were targeted in the 5th millennium (Fig. 5.12).

The combined effect of size and distance emerges more clearly from graphs 5.13 to 5.17 (however, numbers are in some cases small). Fig. 5.13

shows that, in the western Mediterranean, most large (>20 sq km) and distant islands (>50 km) (in red) were colonised either before or after the Neolithic (none in the 5th-4th mill. cal. BC), whereas most small nearby islands (in blue) were colonised during the Neolithic. As one would expect, the colonisation of small nearby islands (blue in Fig. 5.13) followed roughly the same pattern as that of large nearby islands (red in Fig. 5.14) (i.e. Neolithic colonisation, with the 8th millennium exception of Corsica). Fig. 5.14 also shows that small far-away islands (in blue) were mainly colonised from the Bronze Age onwards (with the exception of Susač and Filicudi, both of which were colonised earlier and were easily reached via stepping-stone islands colonised at roughly the same time).

For the Eastern Mediterranean (Figs. 5.15-5.16), most large islands (>20 sq km, red in both graphs) were colonised between the Neolithic and Bronze Age (5th-3rd mill.) regardless of distance. Most small and far-away islands (blue in fig. 5.16) were colonised from the Early Bronze Age onwards, whereas the colonisation of small close-by islands (blue in Fig. 5.15) took place gradually from the 5th millennium cal. BC onwards. Overall, Fig. 5.17 shows that the colonisation of small far-away islands (those less favoured by biogeography) in the eastern Mediterranean (red) seems to take place from the Bronze Age onwards, whereas in the western Mediterranean (blue) it is more evenly spread out. For the Eastern Mediterranean, the lack of colonisation of larger islands in later periods (3rd mill.) is likely to reflect the fact that most of these had already been occupied by then, thus the pattern appears to date expansion into the smaller islands.

Similarities and differences between colonisation rates at this geographical scale are interesting, but necessarily of a general nature. Modelling colonisation should not stop at the pan-Mediterranean level, but rather focus on patterns of regional and even local development if the relative importance of different factors is to be established. The following sections will analyse the colonisation trajectories of a few archipelagos, sometimes with similar and sometimes with different geographical configurations, as a key to understanding small-scale patterns.

Regional Patterns of Island Colonisation

A number of Mediterranean archipelagos have been thoroughly investigated, thus providing us with the opportunity to investigate colonisation (and later in this thesis abandonment) on a comparative basis. This kind of comparative analysis allows us to single out factors that may have been prominent at both a general and a local level. In this section, the colonisation data from individual island regions are incorporated into plots, and then compared against each other. By applying this methodological framework to island groups from different parts of the Mediterranean, 'anomalies', i.e. exceptions to the general trends of colonisation seen through the graphs (rather than exceptions to the outcome predicted by any theoretical model, e.g. biogeography), can be singled out, and similarities or patterns described and assessed.

Depending on the data available (this being the main restriction on this study), the graphs show either how many islands were colonised during each millennium (these graphs provide the focus for the analysis in this chapter) or, by incorporating instances of abandonment, how many were actually inhabited during each millennium (these will be reviewed in more detail in Chapter 7). Needless to say, these graphs respect the current state of knowledge, therefore future finds may alter the patterns observed here. The recent discovery of evidence for human occupation on the islands of Kythnos and Cyprus is a strong reminder of problems relating to archaeological visibility, caused - for example - by soil erosion, or to potential research biases. With this caveat in mind, it is possible to delineate a picture of which islands were colonised when, combining the graphic information contained in the plots with the data in the tables. The cumulative plots have been included as a way of illustrating the potential danger of viewing the islands as gradually filled with no temporal gaps in their occupation. The corresponding non-cumulative plots make the point that colonisation was generally a much more punctuated process, and that, while there is evidence of human presence in most of these islands from the early Neolithic to the Iron Age, this occupation was not continuous. Direct comparison between island groups is sometimes misleading, as they contain different numbers of islands, but, when viewed as percentages, the graphs underscore the high variability in the colonisation rates found in different areas.

Spanish Islands

(Total: 6; average size 850 sq km; average distance from Nearest Mainland 150 km)

The cumulative plot (Fig. 5.19) for the two main Balearic islands (Mallorca and Menorca), the two minor ones (Cabrera and Conejera), and the two Pitiussae islands (Ibiza and Formentera) portrays their colonisation as a gradual filling of the archipelago with no temporal gaps in their occupation. The non-cumulative plot (Fig. 5.20) is based on a recent review of the evidence from the Spanish islands, already discussed in Chapter 4, and shows how many colonisation events took place during each period. Two islands (Mallorca and Menorca – see Table 5.1) were colonised in the 3rd millennium and two more in the 2nd millennium cal. BC (Ibiza and Formentera). The plot also highlights the fact that no islands were colonised in the Late Bronze Age-Early Iron Age, and that four more islands (Ibiza, Formentera, Cabrera, and Conejera) were colonised in the Phoenician/Punic period (in two waves of roughly two at a time), between the 7th and the 1st centuries BC. The plot shows that, in two cases, the same islands were recolonised after being abandoned. A third plot (Fig. 5.21) takes abandonment into consideration, and shows how many islands were actually occupied during each period. It conveys graphically a more accurate representation of the alternating nature of occupation, which will be discussed in more detail in the course of Chapter 7.

Northern and central Tyrrhenian Islands

(Total: 10+2; average size 19.4 sq km; average distance from Nearest Mainland 39.5 km; Sardinia+Corsica: average size 16,400 sq km; average distance from Nearest Mainland 146 km)

The cumulative plot suggests a gradual filling of the islands (Fig. 5.22). The non-cumulative plot (Fig. 5.23) reveals human presence (settlement) in these islands mainly from the Middle Neolithic, and again in the Late Bronze

Age/Early Iron Age. The plot also underscores a significant temporal gap between the colonisation of the larger islands, Sardinia and Corsica, and the remaining 10 small islands (no islands were colonised between the 8^{th}-5^{th} mill. cal. BC), and highlights the fact that, overall, colonisation was not continuous. No islands were colonised in the 3^{rd} millennium, but there were further colonisation episodes in the 2^{nd} and 1^{st} millennia involving the smallest islands in the group (see Table 5.1).

Southern Tyrrhenian: Aeolian Islands

(Total: 7; average size 16.6 sq km; average distance from Nearest Mainland 47 km)

The overall trend of colonisation has been summarised in the cumulative plot (Fig. 5.24). The non-cumulative plot (Fig. 5.25 and Table 5.1) illustrates that initial colonisation involved the three islands of Lipari, Salina, and Filicudi (with Lipari slightly earlier than the others), and a further three separate colonisation events involving just one island at a time; it also shows that more islands were colonised in the mid 3^{rd} millennium. A third plot (Fig. 5.26) shows different phases of actual human occupation (as the previous graph includes re-colonisation): by incorporating both abandonment and recolonisation data, it displays, in percentage, how many of the seven islands were occupied at the same time (please note that, as with the Spanish islands, better data allow the definition of shorter periods of 500 years, as opposed to 1000, for these islands). The occupation plot shows that one island (Lipari – see Table 5.1) was the only one to be continuously occupied, while the other islands were abandoned at different times. There was a reduction in the overall occupation in the archipelago during the Copper Age (4^{th} mill. cal. BC), an increase in the 3^{rd}, and drastic nucleation in the Iron Age (1^{st} mill. cal. BC), when only the Lipari acropolis was inhabited. The cumulative plot (Fig. 5.24) fails to highlight both reductions in occupation and presents the history of the Aeolian archipelago in a rather different way, by conveying instead that by the Iron Age all the islands had been colonised at least once. While this is not untrue, it is less relevant than showing how many islands were actually inhabited simultaneously at any given time.

North African Islands

(Total: 11; average size not available; average distance from Nearest Mainland 12 km)

The earliest evidence for the North African islands (14 are considered here) relies on a series of observations written by French archaeologists in the 1950s. All the assemblages described were surface scatters of lithics, with little (if any) associated pottery. No structural remains are mentioned, and all these indications should therefore perhaps not be taken to represent permanent occupation. The evidence reviewed in Chapter 4, and summarised here in graphic form (Fig. 5.28), shows two phases when activity in these islands appears to have peaked, the Neolithic (5th mill. cal BC) and the Punic period (1st mill. cal. BC).

Dalmatian (eastern-central Adriatic) Islands

(Total: 14; average size 130 sq km; average distance from Nearest Mainland 40.5 km)

The non-cumulative plot (Fig. 5.30) for the 14 Dalmatian islands shows a steady increase in numbers of islands colonised from the 8th to the 6th millennium, with a slight drop in the 5th and 4th millennia cal. BC. The Middle Bronze Age (2nd millennium cal. BC) saw no islands being colonised. This is perhaps paralleled by processes on the mainland during the Middle Bronze Age Cetina period (reviewed in more detail in Chapter 7). Colonisation resumed in the 1st millennium BC.

Ionian Islands (south-eastern Adriatic)

(Total: 7; average size 317 sq km; average distance from Nearest Mainland 15 km)

The colonisation pattern for the seven Ionian islands is seemingly one of regular increase throughout the Neolithic and the Bronze Ages (Fig. 5.31). The Ionian islands lie close to the mainland (between 0.5 and 40 km), which may be responsible for the fact that most islands had been colonised by the 4th millennium cal. BC (for earlier, possibly overland colonisation see Chapter 3). The early overland colonisation of Corfu may be responsible for absorbing the initial colonisation impetus and for the lack of colonisation in the following period (Fig. 5.32).

SW Aegean Islands

(Total: 9; average size 66.5 sq km; average distance from Nearest Mainland 13 km)

The colonisation of the nine SW Aegean islands considered (see Table 5.2 and Fig. 5.34) began in the 5th millennium, dropped in the 4th and resumed strongly in the 3rd. No islands were colonised in the 2nd millennium, while, although en-route to the other islands, the earliest known evidence for the small islands of Antikythera and Atokos is dated 1st millennium BC (lack of research).

Northern Sporadhes

(Total: 6; average size 78 sq km; average distance from Nearest Mainland 38.5 km)

The Northern Sporadhes (six islands) show a rather atypical colonisation pattern when compared to other Aegean groups, displaying substantial temporal gaps between colonisation events (Fig. 5.36). Most of the islands had been colonised by the 6th millennium, while in the 2nd and in the 1st millennium two separate colonisation events involved the islands of Skopelos and Skiathos (see Table 5.2).

NE Aegean Islands

(Total: 8; average size 374 sq km; average distance from Nearest Mainland 29 km)

The colonisation of the eight Northern Aegean islands (see Table 5.2) began in the 6th millennium, and the pattern (Fig. 5.38) was one of steady increase throughout the Neolithic. The first island to be colonised (Thasos) was not the largest but the closest to the mainland (biogeography would favour the colonisation of Lesbos) (Table 5.2).

SE Aegean Islands

(Total: 20; average size 165 sq km; average distance from Nearest Mainland 39 km)

The main colonisation period for the 20 south-eastern Aegean islands was the 5th millennium cal. BC, when 12 (or 60%) of the islands were occupied (Fig. 5.40). A regular number of islands were colonised in the following millennia.

The Cyclades

(Total: 29; average size 85 sq km; average distance from Nearest Mainland 107 km)

If the early and short-lived colonisation of Kythnos is not included, the colonisation of the Cyclades (29 are considered here) started in the 5th millennium, and involved some of the largest islands in the archipelago (e.g. Naxos). The main period for colonisation was however the 3rd millennium cal. BC, when 17 (ca. 60%) of the islands were colonised for the first time. Colonisation continued, at lower rates, up to the 1st millennium BC (Fig. 5.42).

The late colonisation of the Cyclades is striking when the geography of the islands is considered: amongst the Cycladic islands colonised in the EBA, are Ios (109 sq km), Kythnos (100 sq km), and Pholegandros (32 sq km) (see Table 5.2). While it may not be surprising that Ios was not settled earlier, in view of its distance from the mainland (147 km), it is striking that there is no evidence of human presence on Kythnos from the 8th to the 3rd millennium cal. BC, when the island was recolonised. Kythnos falls within the category of Cherry's (1981: 52) 'larger littoral islands' at a mere 39 km from the mainland. Only Pholegandros, in this respect, satisfies biogeographical expectations, being both in the lower size range and further away from the mainland (131 km).

Quantitative Comparative Analysis

In this section, colonisation data from different archipelagos have been grouped together in order to explore potential patterns. The graphs compare how many islands were colonised during each millennium in percentage (absolute numbers appear in the captions to the figures), and thus indicate variations in colonisation rates or trends rather than actual occupation (which will be addressed in Chapter 7). In two cases (Aeolian and Spanish islands) the graphs also include instances of recolonisation (and, for this reason, the totals add up to more than 100%). The decision to compare specific island groups depends on their geographical configuration (usually groups with a comparable total number of islands, total area, distance to mainland, and topographic layout, e.g. 'isolated' clusters of islands vs. islands strung off perpendicular or parallel to a mainland). The similarities and differences that 'matter' when comparing the colonisation trajectories of different island groups have to do not so much with their absolute chronology (i.e. *when* exactly colonisation started, although *where* it started in the group is important) as with their relative timing (i.e. *how* colonisation rates unfolded once begun). The analysis of the graphs will demonstrate that in a few cases similar colonisation trajectories between island groups can be explained by simple biogeographical variables, although in most cases this kind of explanation is not sufficient. In addition, this quantitative work highlights the need to include abandonment in the analysis, as comparing colonisation trends alone (Cherry 1981) gives a misleading picture of actual human presence on the islands (see Chapter 7).

Aegean Islands

Fig. 5.43 displays collectively the non-cumulative graphs for six eastern Mediterranean island groups, while Figs. 5.44-5.61 show the islands grouped two at a time. Fig. 5.43 makes the important point that no single period was key to the colonisation of all island groups, although three periods appear to be prominent. The Northern Sporadhes, the NE Aegean, the SE Aegean, and the Cyclades all experienced (at different times) a main colonisation peak (with 50% or more of the islands colonised in one phase). This was the 6th

millennium for the Northern Sporadhes, the 5^{th} for the SE and NE Aegean islands, and the 3^{rd} for the Cyclades and the SW Aegean. In the case of the Northern Sporadhes (if the isolated 'colonisation' of Gioura in the 8^{th} millennium is excluded) and the SE Aegean, colonisation actually began with such peaks (i.e. an initial 'surge').

Fig. 5.44 shows that the Northern Sporadhes are 'different' from the SW Aegean islands (and other groups, see Fig. 5.43) in that they display a long colonisation hiatus from the 6^{th} to the 2^{nd} millennium cal. BC (in all the other groups, such gaps are usually in the order of a thousand years). The graphs for the Cyclades (Figs. 5.42, 5.43, 5.45, 5.46) show that rates of colonisation there followed a cyclical pattern (with 'ups-and-downs'), which paralleled closely those of the SW Aegean islands in the 5^{th}-3^{rd} millennia (Fig. 5.45). Fig. 5.48 shows that rates of colonisation in the NE and SW Aegean islands (see Table 5.2) were also cyclical, and that both groups experienced peaks in the 5^{th} and 3^{rd} millennia and troughs in the 4^{th} and 2^{nd} millennia. The graphs for the Ionian islands (Figs. 5.47 and 5.49) show that the colonisation of the Ionian islands and of the NE Aegean and SE Aegean islands followed similar trends in the 5^{th}-4^{th} millennia (and 1^{st} millennium for the SE Aegean).

Sicily's Satellite Islands

The evidence from 16 of Sicily's satellite islands (including Malta and Gozo) has been summarised in Figs. 5.50-5.51 (Sicily is regarded as 'mainland' and therefore excluded). The cumulative plot shows that all the islands had been colonised at least once by the 1^{st} millennium cal. BC. The non-cumulative plot shows that, in spite of Sicily's very early colonisation (35,000 BP), the smaller islands were colonised only from the 6^{th} millennium onwards (excluding the 'dry-shod' occupation of the Egadi at lowered sea levels). Overall, colonisation rates were steady, slightly higher in the 6^{th} millennium and again in the 4^{th} and 3^{rd} millennia, after a slight drop in the 5^{th}.

Northern Sporadhes and Tremiti Islands + Pianosa

The decision to group these archipelagos derives from similarities in their configuration already discussed in Chapter 2 and their location relative to core farming zones in the Early Neolithic (Thessaly and the Tavoliere). The colonisation rates of these two groups differ (Fig. 5.52), but both were colonised early (from either the 8th or 7th mill. cal. BC), and from then onwards colonisation was intermittent (which is strange for the Tremiti group, since it comprises three main islands, of which two are close to one another; but also for the Northern Sporadhes, being a chain).

Northern Sporadhes and Egadi Islands

Once again, the decision to group these two archipelagos was aimed at establishing whether islands with similar configurations shared similar colonisation trajectories. Both islands are strung off mainland plains, but the colonisation of the six Northern Sporadhes was spread out, whereas the three Egadi islands were colonised as part of one wave in the 4th millennium cal. BC (after the much earlier 'dry-shod' colonisation of Levanzo at low sea levels, see Chapters 3-4). The uniform colonisation tempo of the three Egadi islands offers a neat contrast to that of the three Tremiti islands (compare Figs. 5.52 and 5.53), which was more punctuated.

Ionian and Dalmatian Islands

These archipelagos display similarities in their configuration that have already been discussed in Chapter 3. In Chapter 4, we saw that both island groups were colonised early; however, the Dalmatian islands became insular before the Ionian ones (Chapter 2), which might account for their gradual rate of colonisation (Fig. 5.54). The differences in colonisation trends of the two groups can perhaps be explained in terms of their arable land and location, and their different potentials for farming (Ionian) and for trading (Dalmatian).

Cyclades and Dalmatian Islands

These island groups are also compared in view of their configuration (they are closely-clustered islands) and in order to investigate the degree of 'autocatalysis' in their colonisation. Colonisation in the Dalmatian islands (Fig. 5.55) began earlier and was more sustained than in the Cyclades (not so if the 8th mill. cal. BC site of Kythnos is included). This may be due to the fact that the Dalmatian islands lie closer to the mainland. On the other hand, once started colonisation in both groups continued with no interruption (stepping-stone or autocatalysis effect), with two peaks (the 6th for the Dalmatian islands and the 3rd mill. cal BC for the Cyclades).

North-central Tyrrhenian and North African Islands

In both these groups (Fig. 5.56) there is a long gap after the initial colonisation of a few islands. In the Tyrrhenian islands this may have to do with the fact that the large islands of Sardinia and Corsica were colonised earlier than the smaller islands (and continued to be occupied, while the smaller islands were not). For the North African islands, there are no obvious biogeographic reasons for this hiatus. The evidence for 5th millennium 'colonisation' consists entirely of lithic and pottery surface scatters, and the break in colonisation may well correspond to actual lack of occupation.

North-central Tyrrhenian and SW Aegean Islands

Both these groups lie in close proximity to their respective mainlands (excluding the large islands of Sardinia and Corsica). The SW Aegean islands lack a 'super-attractor' island (e.g. Sardinia), as Kythera, which is the largest, is removed from the rest. This may account for differences in the colonisation rates of the islands, although there are parallels in the 5th and 4th milennia (Fig. 5.57).

Spanish and Pelagie Islands + Pantelleria

The colonisation trends of these islands, which are considered as the most 'remote' in the Mediterranean, show some parallels (Fig. 5.58). Colonisation events clustered in the 3rd and 1st millennia (Bronze Age and Phoenician colonisation). Of the Pelagie islands, Lampedusa was the first to be colonised, in the 5th millennium. Similar earlier claims for colonisation in the Balearics have been recently dismissed (see Chapter 4).

Spanish and Aeolian Islands

These two island groups are compared as the review in Chapter 4 showed that they both experienced phases of occupational expansion and contraction, with one island constantly occupied (Mallorca and Lipari). Fig. 5.59 includes the recolonisation of some of the islands and shows these cycles graphically (disregarding the fact that colonisation started at different times).

North African Islands and Pelagie Islands + Pantelleria

These island groups are paired because they lie in the southern Mediterranean (some across the Strait of Sicily). The graph (Fig. 5.60) shows that in both cases the 5th and 1st millennia BC were key colonisation periods (the 3rd millennium 'bar' relates to Pantelleria, which may have been already occupied, though not settled, in the 5th millennium).

North-central and Southern Tyrrhenian Islands

In this graph, all the islands in the Tyrrhenian have been grouped together (Fig. 5.61). Colonisation in the southern Tyrrhenian (Aeolian, Egadi, and Ustica) was more gradual than in the rest of the Tyrrhenian, where the presence of two 'super-attractors' may have delayed the colonisation of the other islands (much as we saw for Sicily's satellite islands – cf. Fig. 5.51). Excluding these 'super-attractor' or 'mainland' islands, colonisation began earlier in the south (6th mill.) than in the north-central Tyrrhenian (5th mill.), and was also completed earlier in the south (2nd mill.). There was a colonisation peak in the 4th millennium in both cases.

Discussion

By viewing colonisation processes graphically, we can ask how island groups conform with patterns noted for other archipelagos in the Mediterranean and begin to frame questions as to the potential reasons behind peaks and troughs in colonisation. The graphs display collectively the results of island projects presented in Chapter 4 and, even with the provisos already made there (e.g. different research agendas, uneven exploration), they demonstrate that, both on a pan-Mediterranean scale (Figs. 5.62 and

5.63) and on a regional scale (Figs. 5.19-5.61), the process of acquisition of colonised area was irregular. Figure 5.63, for example, shows the islands divided into three groups: western, central, and eastern Mediterranean. The western Mediterranean sample includes the Spanish islands and the western North African ones; the central Mediterranean includes the Italian, the central North African (Tunisian), the Dalmatian, and Ionian islands, and finally the eastern group includes the islands in Table 5.2, but not the Ionian ones. The graph indicates that, while colonisation in the central and eastern Mediterranean islands groups began early, the islands experienced different colonisation trajectories. The eastern ones were colonised mainly in the 5th and 3rd millennia cal BC, whereas colonisation in the central Mediterranean islands was more evenly spread out. The islands in the western Mediterranean group (there are only 12 islands in this group) followed colonisation trajectories that started later (5th mill. cal BC) and that appear unrelated to the two other groups. Chapter 7 will investigate further how these colonisation cycles related to phases of occupation and abandonment in different island areas, and address whether similar patterns recur under specific geographical or historical circumstances (i.e. potential causes).

The variability of the non-cumulative colonisation plots (Figs. 5.43-5.61) suggests that the causes behind variation are period- and place-specific, although, in some cases, islands that shared similar configuration also displayed comparable colonisation trajectories. The colonisation of the SW Aegean islands and the Cyclades (Fig. 5.45) moved in unison between the 5th and 3rd millennia, and so did that of the Ionian and NE Aegean islands during the 4th and 3rd millennia (Fig. 5.47), and the North African and southern Sicilian islands during the 5th and 1st millennia (Fig. 5.60). Although these parallels do not occur across the board, the examples discussed illustrate that similar colonisation trajectories were in fact at least in part related to a series of spatial variables.

While some subtle similarities can be noted in the colonisation processes in different parts of the Mediterranean (e.g. Spanish and Aeolian islands, Fig. 5.59), the most striking variations take place within archipelagos themselves, particularly amongst small islands that are close to the largest islands. These include the differing trajectories of the small satellite islands off the coasts of Sicily and of the smaller Tyrrhenian islands, some of which lie in sight of Sardinia and Corsica (Fig. 5.61). Once again, small-scale variations, in terms of the islands' local geography and resources, may be responsible for these discrepancies, which suggest that the 'stepping-stone' effect may be far more complex than has been acknowledged so far and that, in order to understand the effect fully, further detailed study of selected islands would be necessary.

The graphs also show that, while comparing colonisation rates between island groups and across periods can give an idea of changing needs and opportunities (e.g. in terms of land and resources), in order to interpret island-human interaction correctly, Mediterranean island prehistory must combine colonisation, abandonment and re-colonisation data. This is regardless of the scale of analysis (pan-Mediterranean, regional, or insular). Human-island interaction can take place at different levels, which are reflected, somewhat problematically, in the archaeological record. Island colonisation in the Neolithic emerged as a pan-Mediterranean phenomenon from the review of the data in Chapter 4 and from the graphs in this chapter (see Figs. 5.62 and 5.64 for a summary). The Neolithic itself should not be viewed as a monolithic block, as it clear that colonisation rates varied over such a long period (Fig. 5.65). This is evident both in the eastern and western Mediterranean from the 5th millennium cal. BC onwards (see Fig. 5.8).

The Neolithic phase tends to be favoured in discussions of island colonisation in view of its pan-Mediterranean dimension. However, some islands, especially in the western Mediterranean (Fig. 5.8), were colonised for the first time in the Iron Age, defying the models analysed in Chapter 3. In fact, most island colonisation models fail to take into account important exceptions discussed in Chapter 4 and highlighted through the quantitative analysis here. Although simplification is inherent in modelling, some explanations are in need of urgent review. The non-cumulative plot for the whole Mediterranean (Fig. 5.8) shows no break in the early sequences for both the western and the eastern Mediterranean (from the 8th millennium onwards); however, there may be some significant differences. In the west, the higher rate of islands colonised in the 6th millennium (when compared to the east) indicates that, on the whole, island life became consolidated earlier there than in the east. Several colonisation models support the idea that island settlement increased with the spread of agriculture (see Chapter 3), which, by the 5^{th} millennium, would have been a rather more established practice. However, the rates of colonisation of Sicily's satellite islands (Fig. 5.51) and of the Dalmatian islands (Fig. 5.30) do not appear to conform to this general model, displaying a reduction in islands colonised in the 5^{th} millennium, when one would perhaps expect a surge based on the pan-Mediterranean trends reviewed so far. Other island groups were colonised altogether much later than the inception of farming on nearby mainlands (e.g. the Spanish islands), whereas others (e.g. the North African islands) appear to have been colonised mainly in the early Neolithic, and thus conform more to the general pattern. These examples illustrate the need 'to distinguish carefully…between coincidence and cause' (Anderson 2004: 262).

Clearly, all the observations made so far should be qualified not only in relation to overall patterns from the pan-Mediterranean record and from previous and successive periods, but also be substantiated by evidence from individual islands. However, to dwell on the general level just a little longer, it is worth restating that there has been an increase in the evidence for pre-Neolithic human presence on islands compared to the late 1980s (Fig. 5.64). Widespread maritime movement, involving islands, though not necessarily their long-term settlement, is evident in the Palaeolithic and Mesolithic, when a few instances of colonisation of true islands are documented, raising the question as to whether we can speak of different types of colonisation. Acknowledging this variation will contribute greatly to recognising sites such as Akrotiri-*Aetokremnos* in the archaeological record, and to attributing to them the correct significance. The intermittent nature of this presence at different times (as variations in colonisation rates seem to imply) will be discussed further in Chapter 7.

Testing Biogeographical Theory: the Case of the Aeolian Islands

The previous analysis identified a few island groups with similar physical configuration and comparable colonisation trajectories. This makes testing the impact of parameters derived from biogeography in the Mediterranean setting all the more pressing, as cause and coincidence need to be disentangled. This section, which draws upon work carried out for my MPhil degree (Dawson 2000), aims to assess the level of applicability of biogeographical theory to a group of islands selected for in-depth study. The Aeolian islands have been chosen in view of their well-established archaeological record, which will act as the data for biogeographical exploration. A series of spatial models drawn from MacArthur and Wilson (1967), Patton (1996), and Held (1989a; 1989b) (see Chapter 3) will be applied to the islands and compared with the archaeological evidence, in order to explore activities such as discovery, colonisation, and inter-island networking (cf. Bass 1998).

The seven Aeolian islands are an island chain and thus offer a large target (cf. Keegan and Diamond 1987: 61), particularly if journeying from Sicily, as they are arranged more or less perpendicularly to the axis of travel (not so from southern Italy). By applying the mathematical formulae discussed in Chapter 3, the islands can be ordered on the basis of their BGR and T/D rankings from a given series of departure points and stepping-stone islands. These rankings indicate which of the islands are likely to support a population and from which departure points the target islands can be discovered most easily. In this study, Capo Milazzo and Capo D'Orlando (both on mainland Sicily) are contrasted as possible staging points to reach the islands (Fig. 5.66).

Area/distance values (BGR rankings) were initially calculated for each island in order to explore the potential for colonisation from the two different staging points (Table 5.5).

Table 5.5 - BGR (area/distance)		
Islands	***Capo D'Orlando***	***Capo Milazzo***
Vulcano	0.706	0.942
Lipari	1.066	1.242
Salina	0.625	-
Filicudi	0.208	-
Alicudi	0.097	0.059
Panarea	-	0.080
Stromboli	-	0.224

Subsequently, the angles that the islands form on the horizon as observed from the two staging points were measured (Tables 5.6 and 5.7) (Salina, Panarea, and Filicudi are not visible from Capo Milazzo; Panarea and Stromboli are not directly visible from Capo D'Orlando) in order to calculate the islands' T/D ratios or their potential for discovery (Table 5.8).

Table 5.6 - Target width from Capo Milazzo	
Islands	***Angle width (in degrees)***
Milazzo- Vulcano	11
Milazzo- Lipari	12
Milazzo-Stromboli	5
Milazzo- Alicudi	2

Table 5.7 - Target width from Capo D'Orlando	
Islands	***Angle width (in degrees)***
Capo D'Orlando- Vulcano	12
Capo D'Orlando- Lipari	10
Capo D'Orlando- Salina	10
Capo D'Orlando–Filicudi	4
Capo D'Orlando- Alicudi	3

Table 5.8 - T/D (target width/distance)		
Islands	***Capo D'Orlando***	***Capo Milazzo***
Vulcano	0.4	0.533
Lipari	0.283	0.396
Salina	0.233	-
Filicudi	0.087	-
Alicudi	0.056	0.022
Panarea	-	0.071
Stromboli	-	0.088

The BGR and T/D values show that, overall, Capo Milazzo is a better staging point for colonisation and discovery than Capo D'Orlando. For example, Table 5.5 shows that Vulcano (the closest island to Sicily) could be colonised more easily from Capo Milazzo (BGR 0.942) (Vulcano-Capo D'Orlando BGR 0.706). Lipari is also likely to have been discovered from Milazzo (higher T/D) (Table 5.8). On the other hand, as one would expect, Alicudi (the most westerly island in the group) is more likely to have been discovered and colonised from Capo D'Orlando (T/D 0.056; BGR 0.097), which lies west of Milazzo (T/D 0.022; BGR 0.059).

Table 5.9 - T/D from nearest island staging-point

From	***To***	***T/D***
Vulcano	Lipari	77.714
Lipari	Salina	10.117
Salina	Filicudi	0.567
Filicudi	Alicudi	0.580
Salina	Panarea	0.470
Panarea	Stromboli	0.547

Table 5.10 - BGR from nearest island staging-point

From	***To***	***BGR***
Vulcano	Lipari	42.971
Lipari	Salina	6.305
Salina	Filicudi	0.539
Filicudi	Alicudi	0.335
Salina	Panarea	0.2
Panarea	Stromboli	0.690

The T/D values indicate that the first islands to be discovered from Capo Milazzo (Table 5.8) would have been Vulcano and Lipari. On the basis of values in Tables 5.9 and 5.10, from Lipari, Salina would be located next. From Salina, where the archipelago branches in two directions, it would be easier to spot Filicudi (T/D 0.567) than Panarea (T/D 0.470). From Filicudi, Alicudi would be spotted next (T/D 0.580). However, Stromboli was likely to be located and colonised from Panarea (BGR= 0.690, T/D= 0.547) before Alicudi from Filicudi (BGR= 0.335, T/D= 0.580). Thus, Alicudi could have been colonised last (Table 5.10). The BGR values in Table 5.10 imply that the order of colonisation would reflect closely the order of discovery (Table 5.9).

Vulcano → Lipari → Salina → Filicudi → Alicudi

Salina → Panarea → Stromboli

Discovery Prediction

Thus the following prediction for the order of colonisation can be made: Vulcano, Lipari, Salina, Filicudi, Panarea, Stromboli, and Alicudi.

Vulcano → Lipari → Salina → Filicudi → Panarea → Stromboli

Filicudi → Alicudi

Colonisation Prediction

Having established a set of biogeographic predictions for the colonisation of the Aeolian islands, the analysis moves on to establish how this model fares when compared with the archaeological data. Lipari, Salina, Vulcano, Stromboli, Filicudi, and Alicudi are all islands with high T/D ratios and 'A' visibility (see Chapter 3). Early occupation (Neolithic Stentinello) is found only on Lipari, Salina, and Filicudi. This is possibly because these islands also have high BGR values (although Vulcano's T/D and BGR are high, the island was volcanically active), good agricultural potential, and there are obsidian sources on Lipari. As expected, Panarea, which is the smallest island in the group (also 'B' visibility), was occupied after this first group of three (in the Middle Neolithic - Serra D'Alto period), but before Stromboli and Alicudi (both 'A' visibility). Stromboli was occupied for the first time in the middle of the fourth millennium BC (Copper Age, Piano Conte phase), and Alicudi was settled last, in the EBA (Capo Graziano phase).

Overall, there appears to be a correspondence between the predictions drawn from the BGR ranking and the T/D ratio and the archaeological record of initial colonisation of the islands. As explained above, the exception to this is Vulcano. The fact that Alicudi, which has 'A' visibility, was colonised last has most probably to do with the island's lack of arable land. Although first colonisation and biogeographical modeling match well in this case study, as we shall see in Chapter 7, the subsequent occupational history of the islands diverges from this model, with the islands experiencing cycles of occupation expansion and contraction around Lipari, which was almost continuously occupied (the most fertile, largest, most central, and with the obsidian). The dynamics of subsequent occupation in the Aeolian archipelago were not just the 'consequences of biogeography' (*contra* Stoddart 1999a: 68).

Bass (1998: 179-183) carried out a biogeographical study similar to this for the Dalmatian islands, and observed that the predicted colonisation trajectory and the actual colonisation data did not coincide. He concluded that resource availability and other variables of a more contingent nature had more impact on early insular activities (Bass 1998: 180, 191). These factors were also prominent in the colonisation of the Aeolian islands; however, their different configuration was perhaps more conducive to a physically more linear colonisation pattern. Although both the Aeolian and the Dalmatian islands are arranged closely parallel to a mainland, from a physical point of view the Aeolian islands form a more discrete group. The Dalmatian islands, on the other hand, create together with other islands a bridge across the Adriatic, and movement across these islands perhaps proceeded in a more reticulate and irregular way than in the Aeolian islands.

QUALITATIVE ASPECTS OF ISLAND COLONISATION

Human/Island interaction reconsidered

The review of the data in Chapter 4 showed that few islands were continuously occupied (this will be explored further in Chapter 7). At least one colonisation experiment appears to have 'failed' on Cyprus. However, whether or not the foragers at Akrotiri-*Aetokremnos* had occupation or seasonal resource exploitation in mind (or if the two were at all different to them) is open to discussion. If we take the latter (resource exploitation) as being the more likely option, the fact they eventually left does not correspond to failure, since it may never have been their intention to settle permanently. Living on the island may have formed part of a strategy involving resource exploitation in several places at different times. Broodbank (1999a: 20) has suggested that the repeated changes in coastal environments may have prompted late Pleistocene and early Holocene island visitation (see Chapters 2 and 3). This would imply that the Aetokremnos foragers were moving to and between a number of places, which included Cyprus. Therefore, place-focused residence or repeated visitation of an island (and not just permanent residence) should also be taken to represent 'colonisation', albeit of a different kind.

The review contained in Chapter 4 and a number of colonisation plots presented in this chapter confirm the fact that the Neolithic was a key period for (a certain type of) colonisation. However, there is also evidence that humans were present on islands before the Neolithic and that wild species were introduced to the islands to broaden the spectrum of resources, suggesting an effective manipulation of resources (Chapter 2). The idea that pre-Neolithic people could not colonise islands successfully should thus be set aside. At the same time, the fragmented record of human presence on the islands (which will emerge much more strongly when the abandonment data are factored into the analysis) offers a strong counterargument to anyone in favour of a long-term trajectory in island colonisation or of the ease of living on islands. While the long-term impression of island colonisation is that of a continuous filling of space, short-term processes differed greatly on the local scale. In the initial stages of colonisation, geographic variables played a role in the discovery of the islands and in their initial use/settlement. But the previous section also highlighted the fact that detailed studies of island basins do not always conform to geographic predictive models, and that a much more sophisticated range of variables was involved, such as culturally driven choices. These variables ultimately resulted in different activities, suggesting that cultural strategies, developed in order to interact with different island environments, may have more to do with island colonisation and abandonment than biogeography by itself can account for.

Human activity on islands has traditionally received headings such as visitation, utilisation, occupation, and establishment (see Chapter 3). The review of the archaeological data presented in Chapter 4 shows that there are problems in linking material data and interpretation (in terms of actual activities), and that there is a pressing need to come up with alternative ideas to this classification. Abandonment and recolonisation, in particular, have so far received little systematic attention in island-related literature. This is partly because colonisation (generally intended as permanent settlement) is often considered as the ultimate goal of human activity on islands. The underlying assumption to such views is that reaching an island is harder than living there or that, once established, social mechanisms ensured the survival of colonies. However, unless we explore what these mechanisms were and how they came about, we might just as well say that colonists survived by some form of inertia.

In the following sections, a selection of sites will be reviewed in detail to discuss different types of activities. These should not be viewed necessarily as chronological stages leading to settlement, but rather as embodying different types of 'activity-sites'. In some cases, the development of a site/colony will go through a series of phases, and where possible this will be explored further. The review will focus on three such activities or phases (visitation, settlement, and establishment), while abandonment and recolonisation will be addressed in Chapter 7. The examples will show that archaeological correlates for these activities are context-specific, and there would be little point in attempting a classification exercise, as categories of remains may represent different or similar activities. There is a great deal of overlapping between these categories, and what may in some cases qualify as 'repeated visitation' in one period or area may amount to 'occupation' in others. Indeed it seems that human activity on islands has been excessively polarised between these extremes. The fact that people went to islands for different purposes, or at least carried out a variety of different activities once they got there, suggests that, whatever they may be, these reasons largely made up for the efforts and risks involved in island colonisation.

Visitation/Utilisation

One of the classic examples of visitation is for the utilisation of a resource. Five Mediterranean islands produced the bulk of obsidian used in prehistoric times (Melos, Lipari, Palmarola, Pantelleria, and Sardinia), while Palagruža and the Tremiti islands had good-quality chert sources. Other islands had metal resources, e.g. Kythnos and Siphnos in the Cyclades produced copper, silver, and lead, which were exploited in the EBA and possibly the FN (Broodbank 2000: 79-80, fig. 19). Evidence for mineral exploitation activity relies on extensive chipping floors or other signs that mining took place on the islands, or on indirect evidence (i.e. material found elsewhere that can be traced back to the islands). As discussed by Cherry and Torrence (1982) for Melos, permanent settlement is not necessary to carry out extractive activities, but as these were likely to require time shelter and food would also be needed.

There are no known built structures to go with the Palaeolithic or Mesolithic exploitation of obsidian from Melos, the Mesolithic exploitation of Lipari, or the Neolithic exploitation of Pantelleria and Palagruža. The Mesolithic exploitation of Lipari obsidian does not seem to be related to its later Neolithic settlement. Only a single fragment of Lipari obsidian has been found so far in Mesolithic contexts in Sicily (at Perriere Sottano) (Aranguren and Revedin 1996: 35), suggesting that exploitation was then unsystematic (Nicoletti 1996: 260). Bernabò Brea and Cavalier noted that the settlement of the island at Castellaro Vecchio seems to coincide with the beginning of systematic obsidian exploitation (1980: 653), which by then was carried out on a much greater scale than before. It seems unlikely that the same people were involved as in the earlier phase.

Similarly, there appears to be no relation between visitation for obsidian extraction (from the 11th mill. cal. BC) and subsequent permanent settlement on Melos seven millennia later (4th mill. cal. BC), despite the fact that Melian obsidian was found in Mesolithic and Early Neolithic layers on the Greek mainland (Broodbank 2000: 110). The village of Mursia was founded on Pantelleria after the island's obsidian disappeared from circulation (Nicoletti 1996: 268), suggesting that here too permanent settlement and initial visitation were not directly related. Three locations on the island have been interpreted as obsidian processing sites: near the modern cemetery, at Punta Fram, and at Salto la Vecchia. Interestingly, these sites lie along the southern coast, far from the obsidian sources, suggesting that during the utilisation phase different parts of the island were in use (the dating of these sites is, however, still in progress) (Nicoletti 1996: 262). Palagruža was never permanently settled (reasons for this will be addressed in Chapter 7), even though its mineral resources were extensively mined (Bass 1998).

It is highly likely that resources other than minerals were sought and exchanged, but their perishable nature has not allowed their survival in the archaeological record. Consequently, quite a few more islands may have been visited without this activity leaving any traces. Only in a few cases, e.g. when cultural deposits have been protected by taphonomy, such as in caves, is evidence for human visitation preserved, but then it is either scant or has received minimal attention. Kopačina cave, on Brač (Central Dalmatian islands), has produced a Late Mesolithic 'cultural deposit', which was taken to indicate 'occupation' around 7000 cal. BC (Bass 1998: 172). There is as yet no known EN evidence on Brač (*ibid.*), and it seems that occupation at Kopačina cave was short lived.

On the islands of Kythnos (Cyclades) (Sampson *et al.* 2002) and Korčula (Central Dalmatian) (Čečuk and Radič 1995, in Bass 1998), two sites have produced early evidence for human occupation in the form of both burial and habitation. Mesolithic evidence from Vela cave on Korčula has received minimal attention (it included two juvenile burials, lithics, animal bones, and shells) (Bass 1998: 173-4). Occupation at this site continued into the EN, and therefore it would perhaps be better placed in the following "settlement" section. The site of Maroulas on Kythnos also spanned the Late Mesolithic-Early Neolithic transition (Kythnos had by then achieved insular status) (Trantalidou 2004). The site excavation revealed a series of human burials, a house floor, and some circular constructions, with the remains of land and marine snails, tunny, and several other fish species (Honea 1975; Sampson *et al.* 2002; Trantalidou 2004).

A further example of visitation in a pre-Neolithic context comes from a site found on the island of Gioura (Cyclops Cave) (Northern Sporadhes), which was also insular at the time. Mesolithic occupation was unearthed at the Cyclops cave under EN, MN, and LN levels (Sampson 1996), indicating that initial visitation of the cave (perhaps centred around late spring) was followed by a more regular use of the cave (dates span from 8400 to 3500 cal. BC) (Davis *et al.* 2001: 79; Trantalidou 2004). Evidence for the initial seasonal occupation of the cave was in the form of fish processing and hunting remains (tools, fish, and animal bones), but there was also the deliberate introduction of wild pigs already in the 9th millennium cal. BC (Trantalidou 2004). Trantalidou also suggests that the hunting strategies of the Mesolithic and Neolithic occupiers of the cave were very similar, and that, during the Neolithic, people engaged in fishing continued to frequent the cave in much the same way as before, although the resources exploited by then also included a range of domesticated species (*ibid.*).

Another form of visitation is for burial or ritual. The site of Calcara on the island of Panarea was interpreted as being the focus of ritual activity centred around secondary volcanic activity ('fumaroles' and bubbling water) (Bernabò Brea 1957). The material found there, in a series of pits, included Late Neolithic fine red monochrome Diana ware, obsidian and flint blades, as well as Greek (4th-1st c. BC) and Roman (1st-2nd c. BC) common pottery, glass and oil lamps (*ibid.*). On the island of Vulcano, a number of prehistoric burials, dated to the first half of the 2nd millennium cal. BC, were excavated in the area of Porto Levante, near the Faraglione Grande, and in the area of the Piano (Bernabò Brea 1957). As a result of this high concentration of burials, the island has been nicknamed '*l'isola funebre*' ('funerary island') (Giustolisi 1995: 10). In classical sources, the island is referred to as *Hiera*, the sacred one, and as the entrance to the underworld (*ibid*). As a burial ground, Vulcano would have been visited by surrounding islanders, and acquired some prominence without ever being settled.

The evidence reviewed indicates that the islands were visited during different periods. Melos was visited from the Upper Palaeolithic (Perlès 1987), Lipari in the late Mesolithic (Bernabò Brea 1957), Pantelleria in the Neolithic (Tusa 1997), and Palmarola in the Chalcolithic (Tykot 1996). As well as for the purpose of burial, there is evidence that Vulcano was visited for the exploitation of sulphur and possibly alum, in the Middle and Late Bronze Ages, as part of Mycenaean trading interests in Sicily and the Aeolian islands (Bernabò Brea 1957: 120; Giustolisi 1995: 52; Castellana 1998; Leighton 1999: 132, 157, 181). Visitation (particularly for exploitation purposes) in these cases should not be seen as an exploratory activity leading to settlement ('scouting'), as it may have been an established practice in its own right. On the other hand, the Mesolithic human occupation at Maroulas, Cyclops, and Vela caves could be seen either as preliminary to more permanent settlement in the EN or as representing actual 'settlement' in a Mesolithic context (or both).

Permanent Settlement

Environmental analysis has demonstrated that the rock-shelter of Akrotiri-*Aetokremnos* (Cyprus) was used year-round, though it is unclear how long this occupation lasted overall (Simmons 1999: 208; note, however, Binford's [2000] doubts, see Chapter 4). Since some degree of permanence has been inferred by its excavators, the site is included in this section as representing settlement in a pre-Neolithic context. The site lacks built structures (being a rock shelter its natural features were exploited as a dwelling), but has yielded a number of cultural features (eleven 'casual hearths') (Simmons 1999: 95). Radiocarbon dates were obtained from only two of these, but, together with other radiocarbon determinations from other areas of the site, they indicate two briefly separated periods of 'primary occupation' (Simmons 1999: 112). The spatial patterning of the hearths and the small size of the shelter suggest some degree of contemporaneity between certain features, while their contents indicate different uses and changes in the intensity of their use over time (Simmons 1999: 115).

During the aceramic Neolithic, permanent settlement, dated to the second half of the 9th millennium cal. BC, is found on Cyprus at a number of locations (e.g. Kissonerga-*Mylouthkia* and Parekklisha-*Shillourokambos*, but not Akrotiri-*Aetokremnos* - see Chapters 4 and 7). At these sites, few structural remains and mainly negative features (pits and water wells) have produced ample evidence for craft specialisation (stone-working) and the use of domesticated animals and plants (Peltenburg *et al.* 2002, 2003).

Settlement becomes more visible/recognisable in many other islands during the Neolithic, through the large numbers of huts (villages) or cemeteries (which can imply occupational longevity). Ftelia (Mikonos) (Sampson 2002), Grotta (Naxos) (Hadjanastasiou 1989), Strofilas (Andros) (Televantou 2004), Kephala (Keos) (Cherry *et al.* 2001), Knossos (Crete) (Evans 1964), Saliagos (Paros) (Evans and Renfrew 1968), Castellaro Vecchio, the Lipari Acropolis, Contrada Diana (Lipari) and Rinicedda (Salina) (Bernabò Brea and Cavalier 1960, 1968, 1977, 1980a), Prato Don Michele (San Domino, Tremiti) (Zorzi 1950, 1954, 1955a, 1955b, 1958, 1959, 1960; Palma di Cesnola 1965, 1967), and several other villages were founded at this time all over the Mediterranean (but see discussion on variation during the Neolithic in previous section). Most display a selection of the classic settlement indicators listed by Vigne (1989), Cherry (1990), and Vigne and Desse-Berset (1995), such as extensive ceramic and lithic surface scatters, post holes, hut floors and hearths, walls, burials, fortifications, evidence for craft specialisation, and evidence for food processing.

Examples of permanent settlement in the Bronze Age come from, amongst others, the Balearic Islands, Pantelleria, several of the Cyclades, Marsa Island, and Vivara. The permanent settlement of the Balearics (which were discussed at length in Chapter 4) may have been preceded by initial visits, but evidence for this is controversial. The Copper Age-EBA village of Ferrandell Son Oleza in Mallorca was founded around 2500 cal. BC, and developed over a period of a thousand years from a cluster of huts to an enclosed compound, with possible evidence for water management, storage, animal rearing, and craft specialisation (Waldren 2002: 302). There is perhaps evidence of human presence on Pantelleria before Mursia was founded, but, as mentioned, the two phases appear to be unrelated. Mursia is a fortified village with a megalithic cemetery dated to the start of the second millennium BC (Tozzi 1968, 1978; Tusa 1996: 389). The monumental burial chambers ('Sesi') suggest that Mursia was a well-'established' settlement (see below). There is also surface evidence (pottery) from elsewhere in the island, suggesting that other areas of Pantelleria may have been occupied at the same time as Mursia (Tusa 1996: 394).

Marsa Island and Vivara are both examples of permanent settlements established for trading during the Bronze Age (neither has valuable mineral resources, but their strategic location along trading routes is clear). On Marsa Island, structural and material remains ('walls and artefacts') spanned a period of three centuries (15^{th}-13^{th} centuries BC), followed by five centuries of abandonment (White 2002: 16). Sporadic occupation (based on pottery finds) resumed in the late 8^{th} to 6^{th} century BC, and from then on it intensified and was continuous up to the first half of the 5^{th} century AD, when the island was re-abandoned until the 17^{th} century (*ibid.*). Vivara was settled continuously from the early 16^{th} century to the late 15^{th} century BC, as part of the Mycenaean trading network (Buchner 1938; Tusa 1991: 11; Pacciarelli 1991; Cazzella and Damiani 1991; Marazzi and Tusa 1994; Giardino 1994: 69-70). Subsequently, the island was abandoned until the 6^{th} century BC (Tusa 1991: 11), and may never have been permanently occupied again (it is unoccupied in the present day). Fragments of Roman pottery dated to the 1^{st} century AD have been found on the island, but no architectural remains. The island's toponym first appears in documents dated to the 14^{th} century and refers to the its *use* as a 'vivaio' or fishery (Tusa 1991: 12).

A few of the smaller Tyrrhenian (e.g. Montecristo) and Aegean islands (e.g. Reneia, Cyclades) (see Tables 5.1-5.2 and Chapter 4) were settled in the Iron Age for the first time, but in some cases there is a likely investigation bias (e.g. Skiathos, in the Northern Sporadhes, which is on the route to most of the others in that group). In most cases there are no documented signs of prior visitation or utilisation. The Iron Age Phoenician settlement of Motya is unrelated to its previous Bronze Age occupation and may reflect a Phoenician trend to occupy previously unsettled areas (Bourain *et al.* 1992: 301).

Establishment

While visitation and settlement are *activities* that may or may not be distinct from each other (see above), establishment is best viewed as a *phase* (both a trading network and a settlement can become 'established' over time). However, establishment cannot be assessed based on 'longevity' alone. Even if good dating is available, choosing a time span (or degree of longevity) that is applicable to all areas, cultures, and periods covered in this study is clearly impossible (cf. a few centuries at Marsa Island and Vivara vs. 1,500 years at Mylouthkia). Establishment can be inferred through an increase in activity intensity, which should be reflected in archaeological remains (e.g. material wealth or evidence for good health). A long-term record of change is thus usually necessary if 'establishment' is to be distinguished from 'pioneering' (or the initial phases of colonisation) (even in the case of well-planned colonisation, e.g. Crete). Peltenburg *et al.* have pointed out that, unless tighter chronological control is available, it is preferable to 'refer to trends of island adaptation, greater elaboration and diversification' (2002: 84). A criterion they explore, which is useful when investigating 'establishment', is the development of an island 'way of life', or the elaboration of insular cultural traits distinguishable from mainland ones, implemented as a way of overcoming specific problems.

Peltenburg *et al.* (2002) defined the occupants of Mylouthkia (Cyprus) as 'well established colonists'. The site was founded in the second half of the 9th millennium cal. BC and was occupied over a period of c. 1500 years (Peltenburg *et al.* 2000: 844, 2001: 40, Fig. 3). Mylouthkia initially displayed several cultural similarities with the Levantine mainland (e.g. chipped stone tradition, domestic architecture, well digging, art) (Peltenburg *et al.* 2000: 845, 2001: 54). The persistence of these parallels has been interpreted as the result of maintained contacts with the mainland (Vigne *et al.* 2000: 83, 98; Peltenburg *et al.* 2001: 51, 2002: 78, 84). Only about a thousand years after initial settlement (around the late 7th mill. cal. BC) did the Cypriot colonists start to adapt this transported/inherited cultural baggage to their island environment, by developing distinctive 'insular' cultural traits (Mylouthkia 1B). According to Peltenburg *et al.*, these traits or 'success benchmarks' are particularly evident in the lithic industry (both in the utilitarian and artistic repertoire) and in the house forms (2001: 52, 2002: 84).

It is worth noting that divergence from long-established cultural traditions could reflect either a state of insecurity or self-assurance, and result from either contact or isolation. In the case of Malta, the development of distinctive megalithic temples has been interpreted in a variety of ways (e.g. 'social isolation', competition, and factionalism). Whatever the case may be, the temple culture came to an end after being 'established' for a period of ca. 1000 years (these issues will be explored fully in Chapter 7). These possibilities suggest that several more phases fall under the 'establishment' heading. In some cases, community well-being or cultural efflorescence (or 'establishment') may be more apparent than real, or at least not sustainable in the long run, as 'factors that promoted constant growth may have generated a trajectory towards disintegration' (Knapp 1989: 200).

CONCLUSIONS

The colonisation data analysis in this chapter began by focusing on the pan-Mediterranean scale, carrying on the task of modelling island colonisation where Cherry left it in the early 1990s, and very much in the same spirit: 'it is more profitable to get on with the job of trying to make sense of what we know *now*' (1990: 203, emphasis in original). The significance of patterns and anomalies was then tested at a regional level, both between regions and within island groups themselves. The study of variations in the patterns of regional colonisation highlighted how humans interact with islands and their resources in different ways. The spatial and diachronic review brought to light both similarities and differences in the cultural trajectories of different island basins: in some cases, these could be explained through their geographic characteristics, while in others the link was less straightforward.

The application of biogeographic modelling to the Aeolian archipelago demonstrated clearly that the configuration of Mediterranean islands calls for the development of tailor-made approaches (e.g. Strasser 2003). Overall, it appears that, while it has little *predictive* power in the Mediterranean, island biogeography is still useful as an *exploratory* tool, as it provides the necessary backdrop for analysing variations in colonisation trends.

Variability in archaeological remains was taken to represent distinct phases leading to permanent settlement (when substantiated by a long-term record), but also to embody different activities or types of island colonisation. This seemed a more viable approach in view of the problems with tying archaeological remains (or lack thereof) to temporal phases. Different groups of people have been traditionally associated with specific types of activities, depending on whether they were hunter-gatherers, farmers, or traders, but several examples in the archaeological record show substantial overlap between these categories and the benefits of composite resource strategies (cf. different kinds of sedentism and mobility) (see Chapter 3). These different types of colonisation require attention, particularly in terms of the conditions that may have stimulated their development. The study of visitation and settlement showed that these activities were carried out throughout different periods (but with different outcomes and for different reasons). Ultimately, it appears more productive to study colonisation by comparing these 'types' across geographical areas and periods.

Island studies have been conducted at two levels, which are on parallel but separate tracks: while in some cases the models drawn from statistical analyses have tended to be too abstract, individual island histories have privileged the detail at the expense of the wider picture. In practice, this chapter has shown that the real depth of the similarities and anomalies highlighted by a statistical approach can be understood only by addressing them through detailed island-histories and geographies, since locally contingent factors may be responsible for different/similar patterns. Comparing the results of archaeological surveys has enormous potential in this respect, since this 'side-by-side' approach can provide (in spite of certain difficulties) both a synchronous and a diachronic image of human land use and occupation (Alcock and Cherry 2004: 4-5). More importantly, surveys can sometimes pick out subtle nuances that characterise different types of human activities on islands, highlighting the fact that settlement should not be favoured when studying colonisation or abandonment.

There is, therefore, a need to conduct island studies at several connected levels. This chapter has demonstrated the strengths and weaknesses of a statistical approach, and the need to test any patterns we may see arising from the data against studies of real islands, first individually, then collectively, and finally comparatively. But most importantly, this review has shown the need to include abandonment in any colonisation study. Accepting that there can be different types of colonisation (each with its own prerequisites, aspirations, and manifestations) provides us with a framework for studying abandonment more effectively. The two are clearly connected. Since abandonment data may illustrate what conditions resulted in the demise of island activities, they can also shed light on what may have prompted them in the first place. However, far from merely taking abandonment as a failed colonisation experiment, we should view it as part of an integral strategy for using landscapes. Between these two extremes lies an array of processes that need to be addressed, and this can be done all the more effectively if colonisation and abandonment are considered in parallel.

CHAPTER 6

THEORIES OF ABANDONMENT

The review and analysis in Chapters 4 and 5 highlighted the fact that Mediterranean island colonisation was not simply a cumulative process, and that it was characterised instead by temporal and spatial discontinuities. Even though, over time, prehistoric people would have accumulated a body of knowledge regarding navigation and the islands themselves, island life was not continuous. At various stages of their histories, islands such as Cyprus, Malta, the Aeolian islands, the smaller Tyrrhenian islands, the Adriatic islands, and the Pitiussae islands appear to have been abandoned and sometimes re-colonised. In several cases, discontinuity in the archaeological record may reflect actual abandonment rather than preservation biases, gaps in our knowledge, or lack of research. A survey of Formentera in the late 1980s found no material evidence that could be dated to the late second and early first millennia BC, suggesting that this island was then uninhabited. Ibiza also appears to have been uninhabited in the same period and to have been recolonised by the Phoenicians (Bellard 1995: 451, 453; Gonzàlez and Díes 1992: 348-53). The archaeological record of the smaller Tyrrhenian islands also reveals great discontinuity, although this might be due to difficulties in establishing synchronous occupation based on ceramic typologies that are too general and often lack regional or localised detail. The review of the data in Chapter 4 indicated that for Cyprus it might be necessary to hypothesise a maximum of three widely separated colonisation events during the early prehistoric period. As mentioned, Cherry saw this as 'wholly unparalleled on any of the other large Mediterranean islands' (1990: 157). However, on closer inspection, this process may be the norm rather than the exception, at least on many islands smaller than Cyprus.

The realisation that colonisation was a staccato process reinforces the idea that, in Mediterranean prehistory, colonisation and abandonment were closely linked processes of cultural development. In previous chapters, factors and causes resulting in such a pattern of discontinuity were addressed in the case of colonisation, while here abandonment will be discussed in more detail. Closely related to abandonment is a discussion of human resilience and adaptability to different types of environment, and the ability to sustain demographically viable communities on islands. These issues will also be addressed in the course of this chapter.

While in previous chapters it was possible to refer to a body of studies dealing specifically with the colonisation of Mediterranean islands (so that theories abound), there is a distinct lack of attention to the subject of abandonment for the Mediterranean specifically. The possible exception to this is Malta, where the transition from the Tarxien Temple to the Tarxien Cemetery phase has been the focus of much debate, an interest that is easily explained by a fascination with Malta's megalithic architecture and its demise. There are many possible reasons for this general lack of literature on the subject of abandonment: a consequence of tying island colonisation to the spread of agriculture has been to assume that once people reached the islands (which is seen as the difficult part), they simply 'got on with it'. In the best of cases, abandonment is seen as a secondary feature of island colonisation processes, but more often as evidence of a failed colonisation experiment. Several abandonment studies, dealing with other geographical landforms, fall within the scope of the 'Processual' (mainly behavioural) tradition (cf. several works by Schiffer). It is surprising, therefore, that, since a theory (or theories) of abandonment exists, no one has addressed its relevance and applicability to the Mediterranean islands. This is partly what this chapter aims to achieve, through direct comparison with areas of the world for which abandonment has been addressed.

Some methodological explanations are necessary at this point. In his study of the Cycladic Islands, Broodbank (2000: 363) mentions that Mediterranean island prehistory is a 'very ancient history, one indeed that came to an end before the start of the Lapita phase in the Pacific and which pre-dates most knowledge of the pre-Columbian Caribbean'. Thus, he argues, although 'serious parallels' can be identified between island societies, processes taking place in islands during prehistory are unlikely to find close parallels in certain more recent island developments (specifically, in the case of recent encounters/colonisation events). Schiffer (1976) and

Wobst (1978) alerted us to the dangers of using ethnographic parallels to understand prehistoric cultural processes. Schiffer pointed out that 'the ethnographic literature used to explain abandonment consists of scattered observations: such information remains to be synthesised, systematized and tested' (1976: 33), and Wobst (1978) cautioned us about the 'tyranny of the ethnographic record'. His point was followed by Bar-Yosef and Rocek (1998: 2), who also warned against imposing the patterns drawn from ethnography (the present) on processes observed in the archaeological record (the past). Nonetheless, it is argued here that, while they cannot provide close parallels, these studies provide a valid (and possibly the only) starting point for investigating abandonment in the Mediterranean. Indeed, historical and even present 'coming and goings' to islands may provide important clues to understanding the timing involved in the success or decline of island life, and some potential causes behind these, as well as illustrating a range of potential human responses to these processes. By drawing on abandonment models developed in other parts of the world (including the prehistoric Near East, the historic American South-west, and the southern-Pacific and Aleutian islands), this chapter aims to test the applicability of both ecological and socio-cultural explanations of abandonment to Mediterranean islands. Throughout this discussion, a major task will be to clarify whether the abandonment of islands is in any way different from the abandonment of other types of environment. The next chapter will look at specific islands in detail and assess abandonment frequency and order of magnitude.

Before these points are investigated further, another methodological issue should be clarified from the start, concerning the scale of the enquiry. Gaps in the archaeological record cannot be automatically assumed to represent 'abandonment', and thus, as we shall see in the following chapter, only islands for which a good archaeological record exists (either intensive field survey data or a fully excavated multi-period site) will be included in the investigation of abandonment. Another issue concerns scale in a different sense. A macroscopic view was adopted when discussing colonisation, emphasising the idea that Mediterranean islands formed networks. On the other hand, a study of abandonment encourages a study at a micro-level: by viewing islands as individual units or nodes, we may determine where and why these networks might have 'failed', or simply changed. These different scales of enquiry are ultimately interchangeable, since a microscopic analysis will also reveal why certain islands within the networks were preferentially colonised (for example, in terms of resources or geographical features). Similarly, as we shall see, by viewing the landscape at different levels, and depending on the questions being asked, abandonment can be investigated most effectively by extending the scope of the enquiry from a micro-level to a regional scale. Broodbank stressed that - in the Cyclades - the maintenance of island networks played a major role in ensuring long-term community survival, and therefore these networks, rather than islands in isolation, should be the focus of our investigation (2000: 110). Nonetheless, by focusing on islands and treating them as defined units of study, we can address absence of activity, which can involve either individual sites (or even individual households) or whole islands, and then extend our investigation to whole archipelagos. Processes taking place on nearby mainland sites are also important, since they can shed light on possible causes leading to islands being abandoned.

What is Abandonment?

Like 'colonisation', 'abandonment' defies clear definition. A common-sense characterisation of abandonment refers to the absence of people where previously they had existed. However, the following review will illustrate that this concept is not as straightforward as it might seem at first sight. Schiffer (1976: 30) defined abandonment as 'a type of cultural deposition process belonging to the S-A type', i.e. a kind of transformation from the systemic ('in use'), to the archaeological realm ('not in use'). He also claimed that 'abandonment processes begin operation only when activity areas are being abandoned', so they should not be confused with 'discard and loss' (*ibid.*). Graves and Longacre pointed out that 'the process of abandonment may involve a number of complexly related events including *movement* by individuals, households, and larger social groups, and *changes* in birth and death rates; these processes may act differentially upon groups that comprise a community' (1982: 201, emphasis added).

These definitions may not cover all aspects of abandonment, but they provide a starting point. First of all, they indicate that if we are to understand abandonment correctly, we must have a good grasp of the events acting within or upon a community and its surroundings. This brings us back to the question of the reliability of the data being used, since we must attempt to both qualify and quantify such processes. Does abandonment refer to the extinction or the movement of people and/or settlements, or can it be extended to any kind of cultural activity? Does abandonment always entail *interruption* or is it rather a *transformation* (e.g. within an island cluster, a process such as settlement nucleation) and therefore does it have an element of continuity?

In his discussion of settlement stability (or instability), Horne (1993) makes a useful distinction between 'occupational' and 'locational' instability. Occupational stability is a temporal concept, and relates to how long people stay in the same place without interruption. Locational stability, on the other hand, is a spatial concept, and refers to the degree to which people tend to settle in the same type of place (e.g. seasonal settlement for pasturage may focus around water sources). Thus, 'an occupationally unstable area may present a shifting scene of people and activities against a backdrop of continuity of location' (Horne 1993: 43). The question posed by this distinction is whether or not an occupationally unstable area qualifies for an abandonment study. In other words, does it make sense to discuss abandonment in the context of highly mobile societies, e.g. in the case of roaming hunter-gatherers displaying a preference for island territories?

Nelson has recently claimed that 'abandonment is a process, not an event...an aspect of ongoing social change and reorganisation' (2000: 55). If abandonment is a process of transformation, where can we draw the line between what is 'in use' (systemic) and what is 'not in use' (archaeological)? Understanding the 'systemic', or the kinds of behaviour that are typical of a community, becomes imperative, if we are to identify securely what really is no longer in use (e.g. sites to which return is not anticipated). Although generally the archaeological record is made up of sites that have not been in use for quite a while, different systemic processes would have led to their abandonment and their incorporation into the 'not in use' realm. In this respect, it may be worth thinking of abandonment as a set of different activities, some belonging to the S-A sphere, others to the S-S one, i.e. in terms of change rather than interruption. However, we still need to be able to differentiate between the two, and the archaeological record provides us with important clues.

Schiffer (1976) defined a set of S-A processes (or behaviours), which, he claimed, take place once sites are abandoned. He defined '*de facto* refuse' production as being the most important. *De facto* refuse consists of material that, although still usable, is left behind when a site is abandoned. It provides an indication of what was being used, but also of the conditions under which a site was abandoned, e.g. availability of transport, distance to the nearest occupied site, and, importantly, whether or not return was anticipated. 'Curate behaviour', on the other hand, is defined as the relocation of material from the old to the new site. Schiffer noted that objects likely to be 'curated' upon abandonment tend to be portable, highly valued, and still usable (1976: 33). The archaeological record can be further modified by scavenging of material left at abandoned sites (*ibid.*), sites which may even be taken over by different individuals (thus returning from the 'not in use' back to the 'in use').

Understanding these behaviours is important because they can shed light on abandonment and its causes. On the basis of Schiffer's distinctions and reasoning, if a floor assemblage is made of many portable, valuable, and/or usable objects it is likely that the structure was abandoned in haste and that departure was unplanned or unexpected. In contrast, if the assemblage has been highly 'curated', so that it contains only large and/or unusable objects, then this is likely to represent a slow, planned abandonment (LaMotta and Schiffer 1999: 23). Ultimately, these behaviours are related to the string of 'events' mentioned by Graves and Longacre (1982). In a study originally reviewed by Cameron (1993: 4), Stevenson (1982) systematically examined the effect of a set of variables (e.g. speed of abandonment and anticipation of return) on several sites within the context of the gold rush in the Yukon. He discovered that in the case of sites that were left rapidly, some structures were abandoned while still under construction. Instead, where abandonment was planned and return anticipated, artefacts might be hoarded or stored (*ibid.*).

These studies rely on a set of least-effort expectations, and are based on the assumption that the composition of abandoned sites is an accurate reflection of the processes that acted upon them: 'the patterned distribution of cultural items and features suggested that the site had a structure which might reflect aspects of the behaviour and organisation of the people who occupied it' (Longacre and Ayres 1968: 151). This, however, is highly problematic, and Binford issued a warning with regard to the risks posed by 'equifinality' (1973) (or the possibility of different processes producing similar archaeological assemblages). Schiffer subsequently explained the dangers of falling prey to a 'Pompeii Premise' in archaeology (1985), or the risk of treating 'housefloor assemblages at any site as if they were Pompeii-like systemic inventories' (1985: 18). Allison pointed out that even Pompeii itself does not conform to the 'Pompeii Premise', since, far from representing a snapshot at the time of the eruption, the city underwent hoarding, looting, and social disorder in the aftermath (1992: 49, 56). Kent (1993) introduced important cultural variables, observing that the nature of the objects found at a site has more to do with the length of time people plan to stay than with how long they actually stay (this is also relevant to colonisation). This is because people who anticipate short-lived occupation tend to have fewer, smaller, and less durable belongings than people who plan to stay for longer (Kent 1993: 66).

The following two examples illustrate some of these points further, i.e. how abandonment behaviours can be contrary to strictly functionalist expectations and how abandonment assemblages can be misleading. LaMotta and Schiffer discussed 'ritual formation processes': these are widely documented in the American Southwest and in much of north America, and occur when houses and their contents (including valuables) are destroyed, usually as a result of the death of one or more of their occupants (1999: 24). Tomka and Stevenson (1993: 194) identified another case that provides us with a similar caveat. In their study of living hunting societies in the northern hemisphere, they noted that resource stress often leads to social tension in the domestic sphere between the sexes, and that this 'resource-induced gender stress' seems to prompt male mobility. As a result, the material assemblage of an abandoned household (accumulated during the later periods of its occupation) would reflect this gender stress, rather than typical gender relations. LaMotta and Schiffer concluded that there is no necessary 'one-to-one relationship' between objects found in a structure and prehistoric activities that took place there, and that the archaeological record should be viewed as a 'palimpsest of deposits related to different phases of that structure's life history' (1999: 21).

The problem with interpreting abandonment processes is further exacerbated by the fragmentary nature of the archaeological record. This, however, may have been slightly exaggerated in some cases, e.g. by Diamond, who described archaeological inference as 'nothing more than a motion picture [reconstructed] from individual frames by arranging them in presumed sequence'. He also defined 'colonization cycles [as] deduced from sequences of such snapshots' (1977: 250). In spite of this incompleteness, it is still possible to formulate a series of hypotheses, e.g. in the reconstruction of settlement patterns and demography, provided that the necessary research criteria are met.

Cherry claimed that islands are 'fragile environments' (1981: 59), but also that one should not expect to find 'the wreckage of failed settlements, since adverse conditions would force people to move back leaving ephemeral traces behind' (1981: 60). This is partly true. However, rather than preventing archaeologists from making their investigation, the incompleteness of the archaeological record should stimulate a demand for a wider array of explanations and a far more enquiring and dynamic approach, which takes this incompleteness into account rather than ignoring it. We should also start to challenge the idea that islands are necessarily 'fragile', as several examples (past and present) show that island communities are resilient and highly adaptable. With this in mind, it becomes clearer that abandonment is not always forced upon a community, since there is evidence that both settlement and activity abandonment were actively selected by human groups even before this was strictly necessary. While it may not be possible to fit in all the bits of evidence into the puzzle and reconstruct an exact picture of island colonisation and abandonment in

Mediterranean prehistory, the more prominent features of these processes can be modelled, also, importantly, through the inclusion of exceptions and/or voids.

Identifying Abandonment in the Archaeological Record: Case Studies

Having established from the start that there exists a strong link between colonisation and abandonment, there are some important caveats to consider in carrying out a parallel study. As mentioned above, a strong side-effect of considering colonisation as a linear trajectory has been to view abandonment as evidence of a failed colonisation experiment. Cameron pointed out that abandonment has been generally interpreted with the 'disaster movie mind set, either in terms of regional exodus or rapid abandonment caused by natural catastrophes' (1993: 3). However, human history is more complex than a simplistic succession of 'don't worry be happy' and 'run for your life' periods, as claimed by Schlanger and Wilhusen (1993: 90), with much of what happens in between these phases (including abandonment) geared towards ensuring continued well-being. Fish and Fish (1993: 108) noted that abandonment in the Tucson Basin took place at a time when nucleation introduced new alternatives for organisational and productive expansion (Classic Period). Indeed, abandonment can be seen as much as 'a strategy for using landscapes, guided by the availability and perception of alternatives, as the failure of a particular structure or adaptation' (Nelson 2000: 52, 57). Abandonment processes span these two extremes.

The way abandonment has been studied has been shaped by the development of archaeology itself, so that one could argue that some views are tainted by a western-centric stance. Approaches have changed from viewing abandonment as an event (usually a catastrophic one) to treating it as a category transcending cultural boundaries, or as a process, generally in response to factors acting on the long-term or regional scale. Abandonment in the latter two senses became a 'hot topic' of the New Archaeology. 'The loss, breakage, and abandonment of implements and facilities at different locations, where groups of variable structure performed different tasks, leaves a "fossil" record of the actual operation of an extinct society'

(Binford 1964: 425). Cameron has pointed out that, problematically, under this paradigm, abandonment was investigated by combining ethnographic, ethnoarchaeological, and archaeological data from different places and times (1993: 3).

Initial studies by Longacre and Ayres (1968) and Lange and Rydberg (1972) focused on individual households, such as an abandoned Apache living site and a recently abandoned modern rural house-site in northern Costa Rica. This may appear at first like a strange obsession with the household and its floor contents, which were meticulously described in reports that echoed culture-historical typologies. Their aim however was far from merely descriptive. Where possible, experiments were carried out and the former occupants subsequently interviewed to verify the accuracy of the hypotheses (Lange and Rydberg 1972: 432). These studies provided 'cautionary tales in which the disparities between archaeological interpretations and systemic reality were demonstrated' (Cameron 1993: 4). Indeed, these initial studies may have been primarily concerned with reconstructing behavioural processes taking place inside individual households and in their surroundings, but, more importantly, they also investigated the actual causes of abandonment. This was made possible by switching between different scales of inquiry. Eidt argued in favour of viewing the landscape at different levels, and concluded that 'when depredation of the landscape reaches a threshold beyond which there is no adequate repair, then parts of settlements, later whole settlements, and ultimately settlement networks may fail' (1984: 5). Abandonment can thus be investigated more effectively by extending the scope of the enquiry from a micro level to a regional scale.

In such a spirit, Graves and Longacre (1982) investigated the abandonment of small and dispersed 'pueblos' and the processes leading to their replacement by large nucleated pueblos on a regional scale (the Grasshopper region of east-central Arizona shortly after AD 1300). Grasshopper was interpreted as representing 'the collapse of an entire system of interdependent communities, a trend of regional depopulation, where distance prevented transport of large replaceable goods, which were simply left behind' (Graves and Longacre 1982: 201). Initially, increased agricultural productivity and the development of a far-reaching exchange network led to nucleation in the region. This was a convenient solution for isolated settlements, since by coming together people could benefit from mutual help (Eidt 1984: 14-17). The Grasshopper network was initially successful but in the long term, intensified agricultural production was not maintained through technological improvements, and increased social complexity was not supported by necessary changes in the socio-political sphere, so that the whole system became vulnerable even to short-term variations, and was ultimately abandoned (Graves and Longacre 1982: 201). Graves and Longacre used this argument to reject a monocausal explanation of abandonment of this area (climate change). Reverting to the previous system was impossible, and the whole region was therefore abandoned as a result (1982: 202).

Another regional study, conducted in the Famorca, Alacant Province (Spain) by Creighton and Segui (1998), also concluded that that the abandonment of small seasonal pastoral sites in recent times was the product of broad changes in landscape exploitation. These changes, which had led to the decline of traditional herding systems, could be traced back to the early 1900s, and were investigated both at the inter- and intra-site level (or at the level of the wider landscape, individual structures, and portable material culture) (1998: 49). Creighton and Segui distinguished between patterns and processes of abandonment, and noted that focusing on the latter emphasises usefully the 'stratigraphy' of abandonment or the diachronic distribution-patterns of material remains (Creighton and Segui 1998: 33). Their study observed that several pastoral structures in the region were on the 'threshold' of the 'systemic' and 'archaeological' contexts defined by Schiffer (1976), and that their abandonment and re-use embodied a 'perpetual, to some extent cyclical, aspect of agro-pastoral land-management' (1998: 42).

Two main emphases emerge from the review so far: the first behavioural, the other causal. The former deals with what happened at a site (in this respect, abandonment becomes a secondary feature, since this kind of investigation can be carried out for any stage of use of the site). However, since the mid-1970s, house floor assemblages have been increasingly used to gauge the causes of structure and site abandonment (LaMotta and Schiffer

1999: 19). 'Abandonment is not just a perturbing factor in the reconstruction of the "real" state of an archaeological site, but an informative aid to understanding local adaptations and long-term processes of settlement' (Horne 1993: 52). In this approach, abandonment *per se*, though not for its own sake, becomes the focus of the investigation.

The archaeological record poses a number of interpretation issues, as 'human behaviour is not always ... packageable into type units' (Green and Perlman 1985: 6). Pettegrew pointed out a problem with the interpretation of surface assemblages (a recurrent set of data on many Mediterranean islands), and the distinction between abandonment and waste assemblages (2001: 205). This point was also raised by Murray (1980), in her cross-cultural study of mobile and sedentary societies (see Cameron 1999: 4). Even when abandonment is firmly identified, problems remain. Is the abandonment in question permanent or temporary? Sites may have been regularly visited (for example on a seasonal basis) or permanently inhabited (cf. Horne's 'locational' and 'occupational' stability). In the former case, it is unlikely that the intervals between visits would qualify as abandonment, because return and all of its social implications would be expected. However, a form of 'punctuated abandonment' can perhaps be envisaged (Graham 1993: 31). If return was anticipated, after how many failed returns could a site be safely defined as abandoned and taken over by a different community? Papers by Tomka (1993) and Graham (1993) explored the composition of sites 'abandoned' by groups who rotate among a series of settlements throughout the year. If people were able to 'read' the material remains found at abandoned sites, this would potentially allow them to understand under what circumstances the site had been abandoned, and influence the decision as to whether or not take the site over. Understanding human mobility is thus important in the context of abandonment.

Schwartz defined migration 'as a geographical movement of individuals or groups over a significant distance' and as such opposed it to '*range expansion* or seasonal movement' (1970: 176, emphasis in original). He defined a 'significant distance' as enough to be 'disjunctive with the old territory, with an area that is unoccupied between the old and new territories, and with this intervening area perhaps being ecologically unfavourable for occupation' (*ibid.*). Another criterion was that movement had to be 'relatively permanent' and as a result the migrating group would abandon the old territory (*ibid.*).

Cameron has pointed out that 'settlement abandonment is "built into" the land-use patterns of many subsistence systems', both mobile and sedentary (1993: 5). As said in previous chapters, Mesolithic settlement patterns could be place-focused, while Neolithic people also were mobile. 'The fact is that *all* societies have a mobility component; the issue is what the form of that mobility is, not whether it exists. Thus analysis of mobility is ... a critical variable in the study of any society' (Bar-Yosef and Rocek 1998: 1, emphasis in original). Similarly, Barkan and Shelton have claimed that 'once the idea of a diaspora is disassociated from the historical experiences of a particular group of people, it becomes a universal designation, applicable to all displaced groups' (1998: 5). This displacement can be fostered either by the perception of a better quality of life (as demonstrated by the abandonment of many Mediterranean islands in the present) or dictated by a question of life or death. Abandonment appears to be a recurrent feature of human social history as a whole: even 'the Greek house in both town and country was portable...[it] was never a fully settled unit, but moved in accordance with political, economic, and social phenomena' (Pettegrew 2001: 197-9; see also Gallant 1991). From prehistory to the present, passing via classical Greece, abandonment was as important as colonisation in ensuring both physical and social survival.

What causes mobility is an all-important question in understanding abandonment. Kent (1993) argued that there is a need for separate models of abandonment behaviours for nomadic, semi-sedentary, and sedentary groups. The underlying common element to all such strategies is movement. There can be many different underlying causes or more immediate triggers of abandonment, which range from environmental stress to cultural processes. Movement can be ingrained in ideology (Anthony 1997; Burmeister 2000) and thus, while it is generally seen as a response to extreme conditions, abandonment should be viewed as a component of a cultural framework, which can be implemented as a proactive strategy or as a precautionary measure even before the need to move arises.

Reasons why groups 'abandoned' or left mainland sites were addressed in Chapter 3, which reviewed a series of colonisation motives, highlighting in effect the intimate link between colonisation and abandonment: colonisation usually involves abandonment at some level, even if just at the local household level, when communities fission and members of a community move away. Graves and Longacre noted, on the basis of ethnographic evidence, that migrant groups are usually composed of members of a community (mostly young couples) who have less access to resources, so that movement represents a reasonable alternative (1982: 201). Using a cross-cultural analysis, Schwartz identified a 'pioneering' phase, a 'consolidation' phase, and a 'stabilization' phase in the development of 'the postmigration community' (1970: 193). However rigidly schematic and strongly 'Processual' Schwartz's observations may sound (see Chapter 3), defining and understanding some regularities in the development of a community configuration is helpful, since abandonment may result from either real or perceived deviation from expected outcomes at any point during these stages. This deviation need not necessarily occur during the pioneering phase (when one would expect the community to be at its most vulnerable stage), but also during the 'consolidation' or 'stabilization' phases, when increased cultural complexity may be masquerading factionalism caused by a decline of resources, and ultimately lead to cultural demise and possibly abandonment (cf. Rapanui's stone 'moas').

Schiffer's caveat concerning the use of selective analogy is relevant to this study since abandonment theories exist for other parts of the world (for example the islands in the Pacific). But rather than ignoring these theories, their degree of applicability to the Mediterranean islands should be established. Several studies on the Pacific islands have dismissed the idea that isolation was a crucial problem of island cultural development in the Pacific. Anderson (2001) has pointed out that isolation (unless extreme) was not *per se* an obstacle to colonisation in the Pacific, but rather a feature of the environment that could be overcome. Other factors (such as commodity transfer) could pose problems, especially if they resulted in 'community isolation' (*ibid.*). Various explanations have been put forward for the prehistoric abandonment of the Pacific 'mystery islands', which, although previously inhabited, were found empty upon European arrival (Diamond 1985; Terrell 1986; Kirch 1988; Irwin 1992; Weisler 1996). These range from environmental catastrophe to social deprivation, and Anderson has suggested that it is likely that a set of circumstances was unique to each island. At the same time, he noted that some factors may have had a broader relevance, particularly differences in availability of marine resources, which act as a buffer (Anderson 2001: 14).

It is on this broad spectrum of elements (environmental, social, etc.) that we should focus in order to understand why islands were abandoned, and to identify a corresponding set of factors in the Mediterranean islands. It is worth exploring why such elements were singled out in the Pacific or elsewhere, while bearing in mind that these may have to do with local colonisation dynamics. In the Pacific islands, the factors considered in most studies include size, altitude, rainfall, soil type, water sources, and marine resources, as well as exceptional climatic events. We shall consider in the following chapter whether any of these had any measurable effect on the Mediterranean islands, and whether other factors were more prominent in their abandonment.

What Can Cause Abandonment?

Approaches to abandonment are based on a range of explanations advocating both non-cultural causes, such as environmental, resource-related ('deterministic') explanations, and cultural causes, including political, social and economic explanations ('agency-based'). Both types may favour either long- or short-term processes, even though processes that appear to be acting on the short term tend to result from forces operating on the long term, as there may be a delayed effect. This was discussed by Renfrew (1978a), who described abrupt change in behaviour (e.g. abandonment) in terms of 'smooth continuous changes in the underlying causative factors', by means of Thom's (1975) 'Theory of Elementary Catastrophes'. This catastrophe theory argues that discontinuities within a system can be caused by a gradual change in the forces acting upon it, and not necessarily because of sudden changes in such forces (1978a: 204). According to Renfrew, this theory can be applied to Systems Collapse and it can also explain processes such as shifts in settlement patterns (*ibid.*). Although a technical term, 'catastrophe' as a side-effect reinforces the idea of failure.

Studies on 'collapse', particularly of complex societies, are clearly not directly applicable to the abandonment of early farming societies, nonetheless some of the mechanisms they explore are worth pursuing. Knapp (1989) reviewed a series of collapse studies focusing on Mesopotamia (Yoffee 1979; Yoffee and Cowgill 1988), the Maya (Culbert 1988), Rome (Bowersock 1988), Han China (Hsu 1988), and South/Southeast Asia (Bronson 1988). He pointed out that the authors of these studies contended that 'no "civilization" ever collapses rapidly, or equally in all its subdivisions' (Yoffee 1988: 18; Adams 1988: 21), with the possible exception of collapse induced by natural disaster. Knapp contrasted this approach with Tainter's model of collapse. Tainter viewed collapse as 'a sudden, major, all-or-nothing proposition', regardless of type of society or level of complexity (1988: 4-5). Whereas Yoffee regards collapse as the 'restructuring and reintegration of social institutions' (1988: 11-14), Tainter regards it as an 'economising process', a return to 'the normal human condition of lower complexity, once the costs of complexity begin to outweigh the benefits and there is no significant technological innovation or no new energy sources are acquired ("Law of Diminishing Returns")' (1988: 111, 198). Knapp ultimately questions the fact that declining productivity can be taken to underlie collapse in general, and argues that Tainter's 'grand theory' cannot be applied to individual cases (1989: 203, 206).

The studies mentioned above are relevant to this discussion in that collapse (like abandonment) can be viewed as a form of local discontinuity, which is not necessarily pervasive at all levels of the cultural structure experiencing it. However, the two processes should not be confused, nor, as we shall see, is collapse necessarily a prerequisite for abandonment. There is, however, at least one important lesson that can be learnt from studies of collapse: Tainter (1988: 198) points out that societies collapse not because they cannot adapt to change, but because they select collapse as the most viable solution to adversities (in his model, the main obstacle is declining productivity, but this is not necessarily the only reason): in other words, Tainter argues that collapse is adaptive.

There is a tendency in the literature to interpret system collapse, as well as abandonment, as a response to ecological stress, whether induced by climatic change or human action (Bintliff 2002). However, human impact on island environments is being re-evaluated, in particular, on small islands (those usually considered as most vulnerable), where activities such as farming were carried out on a small scale and are unlikely to have caused much environmental damage (Butzer 1982, Robb and Van Hove 2003: 251). Nonetheless, approaches based on ecological explanations must be investigated, particularly those that favour explanations founded on the idea of a punctuated equilibrium or non-linear development, which is potentially relevant to understanding cyclical processes of abandonment. However, a multi-causal explanation is preferable.

Bowdler's (1995) work on the colonisation of the Australian islands (already discussed in Chapter 3) put forward some hypotheses also for their abandonment by way of a combination of factors. Bowdler discussed the 'phenomenon of islands becoming islands' (1995: 945) and linked the initial abandonment of the islands to their insularisation at the end of the Pleistocene. Rising sea levels meant that coastal mainland territories became islands and that people found themselves stranded there (cf. Broodbank's [1999] 'dry-shod' colonisation). Increased isolation and pressure on resources may have caused people to either move away or die out (because of a loss of maritime skills) (1995: 945). Bowdler (1995) also considered recolonisation and subsequent abandonment on some of the islands. Certain Australian islands were not occupied or visited by Aborigines at the time of European contact (e.g. Kangaroo Island) but others were. Amongst the latter, Tasmania has been occupied continuously since ca. 35,000 BP; while others, such as Hunter Island (north-east of the Tasmanian coast), display a punctuated settlement history: the island was occupied during the Pleistocene and then abandoned only to be reoccupied ca. 6,000 BP, re-abandoned ca. 4,000 BP, and then re-occupied or visited from ca. 2500 BP (Bowdler 1995: 950). Bruny Island, off Tasmania's eastern coast and slightly easier to access than Hunter Island, displays a similar occupation trajectory, although Bowdler points out that these parallels may be purely coincidental and that there is a general lack of patterning (*ibid.*). In both cases, however, Bowdler explained initial abandonment by insularisation and subsequent abandonment by cultural and environmental factors: increased physical isolation from the mainland (and Tasmania), the 'abandonment' of watercraft technology, and decreased reliance on marine resources (1995: 954-6). More islands appear to have been brought into use from ca. 3000 BP and from 1,000 BP, when maritime skills appear to have been 'rediscovered' and intensified (Bowdler 1995: 955).

The vicissitudes suffered by the inhabitants of the island of Salina in historical times also benefit from being interpreted through a multi-causal approach to abandonment. Their history provides a cautionary tale with regard to the potential dangers posed by both culture and nature or, in this specific case, by 'pirates and parasites' (Cruz *et al* 1987: 111). During historical times, the Aeolian archipelago was subject to pirate incursions for centuries, and as a result suffered dramatic fluctuations in population. When the fortress of Lipari was captured by Khayr-ad-Din (better known as Barbarossa) in 1544, almost the entire population (ca. 9,000 people) was deported off the islands into slavery (*ibid.*). The Spanish rulers soon organised the resettlement of Lipari, but Salina remained deserted until the British and French fleets stopped the incursions. The Church, which owned most of the island, was then able to lease the land for the production of Malmsey wine to private entrepreneurs, who brought in immigrants from other islands as well as from Genoa, Naples, and Sicily to work the vineyards (*ibid.*). As a result, by the middle of the 19^{th} century, Salina had become a prosperous mono-crop plantation, with a population of almost eight thousand inhabitants, mainly devoted to viticulture and the shipping of wine. When a *phylloxera* epidemic attacked the vineyards, many islanders were forced to leave, and population declined by 40% (from 7,200 inhabitants in 1891 to 4,300 in 1911) (King and Kolodny 2001: 244). The Malmsey wine market could not stand the competition posed by dessert wines such as port, sherry, and others from Portugal and Spain (Cruz *et al.* 1987: 111). Emigration continued until the end of the 1960s, and the 1971 census counted less than 2,000 people on the island, a trend that has reverted only in recent times thanks to the tourism industry (King and Kolodny 2001: 244).

The Dalmatian islands suffered a similar fate. In the present day, only 66 out of hundreds of Dalmatian islands are inhabited. Of these, 43 are inhabited permanently, the other 23 being occupied seasonally or as the sites of lighthouses, churches, and monasteries (King and Kolodny 2001: 258). The population grew during the second half of the 19th century, when many of the islands specialised in the production of wine, benefiting from the fact that competitor vineyards in France and Italy were already diseased, and from their easy access to the Austro-Hungarian market. When in 1894 the parasite *phylloxera* arrived on the islands, it proved impossible to replant or develop new production strategies, and as a result there was massive out-migration (King and Kolodny 2001: 249). Not all the islands, however, were affected in the same way. The census data indicate that the larger islands (>2000 inhabitants in 1981) lost 30% of their population over the period 1910-1981, the middle-range islands (500-2000 inhabitants in 1981) lost 52%, and the smallest islands (<500) suffered the highest out-migration, 70% (Starc 1987: 150). The larger islands were the first to suffer population loss, whereas the inhabitants of the smaller islands mostly stayed during the 1910-1953 period, but left at a far higher rate than the inhabitants of the larger islands in the years after the second world war (*ibid.*). There were also differences between the inner and outer islands (the latter lost their population at four times the annual rate of the former – 2.4% against 0.6%) (*ibid.*). Within the islands themselves, there were noticeable differences: coastal settlements lost one-fifth of their population, whereas villages in the interior lost one-half in 1948 and 1981. In 1981, nearly 80% of the Dalmatian island population was focused on coastal settlements, and the remaining population in the interior consisted mainly of elderly people (King and Kolodny 2001: 250). Populations on a growing number of islands has dropped to less than 500 people, which is roughly the minimum size for a sustainable isolated community (King and Kolodny 2001: 251).

History has several other warning tales on 'plantation islands' (Braudel 1972: 155-8), both within and beyond the Mediterranean: the chain of 'sugar islands' (from Madeira and the Canaries to Cape Verde and São

Tomé); Sicily (which was mainly devoted to wheat from Roman times onwards); Djerba (olives); Corfu, Zante, and Crete (wine and olives). These single, or dual, crop economies were usually detrimental to the islands' economy in the long term. Schneider and Schneider (1976) attributed Sicily's early 20th century out-migration towards the United States and Northern Italy and Europe to its overdependence on wheat. Historical events illustrate how specialisation and heavy dependence on external markets make island economies highly vulnerable to fluctuation. In the early 20th c., the Dodecanesian islanders specialised in sponge fishing, a market that prospered until Italy captured the islands, resulting in large-scale migration to the USA and population reduction by 90% (Vernicos 1987: 105). However, in the short run, monoculture could be beneficial, for example by permitting the inhabitants of Crete to survive under heavy restrictions during the second world war (King and Kolodny 2001: 244).

Vernicos, who applied systems analysis to the study of historical island societies (which he defined as 'open systems' [1987: 102]), argued that their openness to the external world made them highly vulnerable. He identified 'three fragilities' corresponding to three subsystems within the insular system: ecological, economic, and social (*ibid.*). These were explored within a world-system context; nonetheless, the three fragilities provide us with parallel avenues for the discussion of prehistoric abandonment, and with the opportunity to consider whether the supposed fragility of islands at different times is intrinsic or induced.

The Ecological Factor

Butzer has claimed that 'the history of land use and landscape ecology in the Mediterranean basin was a checkered one, with punctuated changes, long intervals of stability, and shorter episodes of mismanagement, periodically interrupted by ecological recovery' (1996: 145). Bintliff (2002) recently reviewed approaches to the causes and effects of Holocene erosion and alluviation in the lands around the Mediterranean. He noted that, while overall detailed regional studies seem to support Vita-Finzi's (1969) punctuated-equilibrium perspective, they also indicate the need to modify its chronology on the local scale (2002: 418). Vita-Finzi (1969) viewed erosion as being rather limited, in spite of intense settlement and use, and restricted to two periods, the Older Fill (during the last glacial maximum) and the Younger Fill (in late Roman times and the Middle Ages). Bintliff, however, identified additional erosional phases, such as in Greece during the EBA (which he linked to the spread of farming sites) and in the late Classical to early Hellenistic periods (which he linked to higher population densities) (2002: 418-9). He suggested that phases of erosion and alluviation in the island of Melos (Renfrew and Wagstaff 1982), Eastern Attica (Paepe *et al.* 1980) and the Argolid (Pope and Van Andel 1984; Jameson *et al.* 1994) were also linked to periods of prosperity and decline in human occupation (Bintliff 2002: 419). Van Andel *et al.* (1986) also explained that while the Older Fill had been caused mainly by a climatic event, human action was likely to be responsible for later erosion events. Wood clearance resulting from rapid settlement expansion would cause soil erosion and stream alluviation; while if a heavily populated countryside area was abandoned, lack of terrace maintenance would cause slopes to collapse (Bintliff 2002: 419).

Bintliff, however, also pointed out some important exceptions to these explanations: lack of erosion was explained by good soil management practices in the highly populated Late Bronze Age, and by rapid reforestation of abandoned land during the post-Mycenaean Dark Ages, when population levels dropped dramatically (*ibid.*). Van Andel *et al.*(1990) linked major sedimentary series to a parallel set of human actions on Thessaly's landscape. Bintliff, however, mentions that further studies in the Thessalian plain seem to confirm that erosion there started before the founding of the first farming settlements. This indicates that soil changes tend to have remote underlying causes, and that investigation should not stop at the first possible cause if such processes are to be understood fully and correctly (cf. Ballais 1991, 1992, 1995).

Anderson raised the question as to whether human-induced changes in the landscape (e.g. irreversible deforestation) could be linked to differences in settlement history between Remote Oceanic islands. Most of these were inhabited continuously, but settlement is thought to have declined or disappeared on several islands in East Polynesia, where only the larger high islands were continuously inhabited. This, however, could not be related to anthropogenic changes, which, according to Anderson, can be regarded as normal, or 'constants of the settlement process' (2002: 374). In his view, human-induced changes to the landscape, and even mismanagement, would only have a limited impact on the islands overall. He claims instead that late Holocene climatic patterns, ecological complexity, and isolation may have been more influential variables (*ibid.*). Several Polynesian islands were very isolated but continuously occupied up to the present (e.g. Niue and the Chatham Islands). Occupation has continued to the present on Easter Island, which suffered the same level of degradation as Pitcairn (where abandonment has been linked to soil erosion). In addition, pollen analysis shows that some abandoned islands such as Raoul, Norfolk and Henderson were never severely deforested in the prehistoric era (Flenley 1993; Anderson 1997).

In the Pacific, access to non-marine faunal resources does not appear to be a significant factor either, since settlement was continuous on islands which had only one domestic species or none at all, even after entire bird colonies were killed (Anderson 2001: 16-7). Instead, Anderson argues that the main differences between islands that were inhabited constantly and those that were abandoned lie in their coastal morphology: four abandoned islands (Henderson, Pitcairn, Raoul, and Norfolk) have a narrow fringing coral reef or subtidal coral, and thus lack several marine species of inshore fish which are coral-dependent. This is in contrast to continuously occupied islands that display better conditions for fishing and shellfishing. Although agriculture offered a buffer against failure on all of the islands, Anderson believes that reliance on crops rendered the populations even more vulnerable to drought and hurricanes, since naturally occurring resources were being depleted, especially on small islands (2001: 22).

Ultimately, views differ greatly on how humans impact on the environment. Some argue that humans were 'mismanaging' the environment by actively depleting resources (e.g. Köhler-Rollefson and Rollefson 1990; Bahn and Flenley 1992), and others that they were ultimately 'improving' it (e.g. Spriggs 1985; Anderson 2002). Clearly, the solution to this issue must remain context-specific. Köhler-Rollefson and Rollefson (1990) claimed that substantial ecological damage could occur over fairly brief periods, with very small groups of southern Levantine Neolithic people inducing the abandonment of their settlements by the end of the 7th millennium by practising excessive deforestation (which led to erosion and decline in soil fertility) (Rollefson and Köhler-Rollefson 1989). In a similar vein, Waldren (2002) argued that human mismanagement of resources was largely responsible for the demise of settlement on the island of Mallorca, in the Son Oleza Chalcolithic Old Settlement, between 2500 and 1400 BC. There was evidence for good water management at this site, in the form of an effective hydraulic system (reservoir, channel, and catch basin), indicating that lack of water (or at least water mismanagement) was not a factor in the abandonment of this settlement (Waldren 2002: 306-7). Instead, Waldren suggested that the initial group of settlers (12 to 16 individuals) began a process of severe soil erosion by slashing and burning the *quercus* oak forest, and that by 1300 BC soil loss was such that the area had to be abandoned (2002: 305). In this model, anthropogenic change is seen as causing severe damage and ultimately the abandonment of the area.

Butzer claimed that 'prior environmental experience cannot be transplanted onto new ecologies without initial damage' (1996: 146), but also that it is unclear whether such initial damage, similar to that described by Waldren (2002), can be related to local abandonment and settlement dispersal into new areas (also Butzer 1990). Nonetheless, Butzer observed that settlement surveys in some regions had picked on areas of very low archaeological visibility during the Early Neolithic/Early Bronze Age period, which could represent instances of 'real abandonment' lasting roughly 500 to 1000 years (1996: 146). In spite of localised episodes of abandonment, initial damage may have been followed by a general enhancement of the environment (though the effects of this 'enhancement' in the long term are a cause of concern even in the present day). Similarly, Anderson has highlighted the need to 'weigh the ecodisaster of local fauna against the ecotriumph of success of human colonisation of Polynesia' (2002: 374). He concluded that, without such initial damage, it would have been impossible for people to inhabit Remote Oceania (*ibid.*). Rainbird

(2002) indicated that, in the Pacific region, there is environmental evidence (Spriggs 1985: 429) that humans were enhancing rather than degrading the environment: in some cases, the islands were physically 'extended', by the intentional creation of artificial platforms and islets, by controlling coastal progradation, and by valley infilling (e.g. at the site of Nan Madol) (Anderson 2002: 445). In the Aegean, the introduction of slope terracing can be considered another form of human enhancement of the environment (Frederick and Krahtopoulou 2000).

The studies reviewed so far raise two important issues: one relates to the nature of climate and ecological processes (and their potential causes), the other to their time scales. Broodbank (2000), for example, raised the question as to whether long-term medium/poor conditions were more or less detrimental to human survival than sudden disasters (e.g. hurricanes or severe droughts). The answer has to do with the sorts of strategies that people implement. Butzer suggested that the overall longevity of human occupation around the Mediterranean basin was partly the result of the efficiency of the basic Mediterranean agrosystem, which relied on 'risk-minimisation by a sequence of activities' (1996: 145). Another successful strategy involved seasonal transhumance between lowlands and adjacent highlands. This would not have been practical in many small islands (which lacked the highlands); however, Broodbank has pointed out that the movement of flocks to Mediterranean islands during the summer is known from ethnographic evidence (2000: 127). According to Butzer, transhumance both complemented agriculture and provided a long-term way of using marginal lands, and in some cases played a role in the resettlement of abandoned areas (1996: 143).

Other researchers have followed up this point. Robb and Van Hove argue that most Neolithic communities had a variety of subsistence strategies at their disposal, and that elements of choice were partly responsible in shaping Neolithic land use (2003: 251). They claim that 'acceptable levels of landscape occupation' may have been determined by a 'feeling of crowding', and that land use was a 'social and cultural decision, not a simple response to need' (*ibid.*). Mannino and Thomas (2002) have also emphasised the advantages of a mixed economy. They suggest that, in many cases, human settlement and subsistence in coastal environments would have been preferable to more fully terrestrial environments and economies (2002: 452). They also link human mobility in coastal environments (partly linked to shellfish exploitation) to the colonisation of new territories, which were likely to be reached through coastal and riverine courses (Mannino and Thomas 2002: 468).

While understanding the environment is clearly fundamental if we are to fit colonisation and abandonment in the right context, an approach that is environmentally deterministic is inadequate. Bahn and Flenley's study of Easter Island (Rapa Nui), in which excessive deforestation is the key element, succumbs to this tendency (1992), although, in view of its extreme isolation, Easter Island may indeed be the exception. Weisler, on the other hand, interpreted the abandonment of the isolated island of Henderson, after it had been occupied continuously for 600 years, as being the result of multiple causes, but particularly of the non-reciprocal nature of the relations between outlier islands, with some islands more reliant on others for survival (1995: 380). Weisler claims that sustained human occupation of the marginal islands relied on regular contact with islands with more resources (also for human reproduction) (*ibid.*). In spite of its geographic isolation, throughout its prehistory, the Pitcairn group (which includes Henderson) was part of a larger interaction sphere that included Mangareva (ca. 400 km to the west). Events on Mangareva caused these contacts to cease (after AD 1450), and the few Henderson inhabitants soon suffered the effects of isolation, including inbreeding and disease (Weisler 1995: 402).

In the case discussed, geographic isolation was not an immediate cause of the island's abandonment, although anthropogenic damage on Mangareva (depleted resource base, massive deforestation, and erosion) is singled out as causing the demise of ocean-going voyages (Weisler 1995: 402). According to Anderson, cultural rather than geographical factors of isolation were prominent in the abandonment of certain Pacific islands, even if physical isolation is likely to have induced social pressures to abandon very isolated islands, especially once the easily accessible resources were severely depleted (2002: 385).

It seems safe to say that only extreme geographical characteristics had a major impact on the settlement history of the Pacific islands (very small, low, or distant islands were either abandoned or never colonised). Such extreme geographical characteristics are an exception in the Mediterranean; however, their relative effect could be significant also in that setting and will be assessed in the following chapter. Cruz *et al.* classified islands into 'dominantly emigrant islands' and 'dominantly immigrant islands' (1987). King and Kolodny singled out Corsica as being the only large Mediterranean island whose demographic history is one of long-term decline, more in line with that of the smaller islands in the Mediterranean, such as the Dalmatian islands or the Cyclades (2001: 248). In the Pacific islands, humans managed to manipulate resources effectively and as long as possible, in some cases sustaining populations against all odds. The next section focuses on this ability, dealing with both expected and observed demographic development in both mainland and island contexts.

The Demographic Factor

This section investigates the degree to which fluctuations in the size and composition of human island populations are related to abandonment. Demographic studies 'provide numerical answers', making them very enticing to archaeologists (Black 1978: 73). However, before we can model island demography appropriately, we must first understand some of the underlying mechanisms ruling demographic estimations, as well as how island-human networks operated in prehistory. With respect to the latter, we may even think of people as a 'scarce resource', a definition offered by Broodbank (2000: 88) in the context of the EBA Cyclades but which, as this section will demonstrate, holds a broader relevance to islands in general.

According to Vernicos (1987: 103), 'the size of a population may be considered as one of the best, long-term, indicators of the evolution of man-nature systems'. He also claimed that 'available data from Mediterranean and other islands in the world strongly correlate to the economic evolution', a concept echoed by Osborne, who states that 'population levels relate directly both to levels of consumption and production' (2004: 163). Cruz *et* *al.* also argue that, in history, population is related to economic, social, geographic, and other opportunities, whose variability is responsible for the 'zig-zag' pattern of demography (1987: 110). Paine, on the other hand, has pointed out that it is not clear whether population growth should be viewed as 'an independent, constant process that promotes culture change...or a dependent variable controlled by available resources' (1997: 1-2). The important question to ask is whether or not population fluctuations, which can be considered to be a constant feature of human development, had any effect on cultural processes, overall and/or locally.

In order to address the question, I begin by focusing on the mechanisms that regulate population fluctuations. In the case of islands, maximum carrying capacity needs careful consideration, as well as an estimation of island minimum populations and how these may have evolved. A dwindling population will either die out or develop an alternative strategy in order to ensure its survival. If population numbers are growing out of proportion (actual or perceived), a different set of social mechanisms affecting reproduction (e.g. marriage rules, birth control practices) may be adopted by a community, affecting its composition in the long run. If this fails, a group of people might decide to move to another island or return to the mainland. Different circumstances will lead to different survival strategies, in turn creating a new set of circumstances. In this respect, although intuitively both very small and very large population numbers may be considered to cause abandonment, this is not always the case. Therefore, population numbers should not be taken in isolation, since several other factors need consideration. King and Kolodny (2001: 245) pointed out that island demography is complicated by internal and external interactions (such as fertility, mortality, migrations, famine, epidemics, piracy, wars, storms, eruptions, earthquakes, and so on).

'Any isolated or local population runs a finite risk of extinction' (Diamond 1977: 256). Island human populations, especially if small and extremely isolated, have been traditionally viewed as more vulnerable to extinction. This is because small populations are more susceptible to random variations (e.g. all offspring of the same sex, or total death of members of one sex) (*ibid.*). However, in the Mediterranean, Broodbank and Strasser

(1991: 241) have pointed out that the mean size of the islands is larger than 10 sq km in area (below which extinction risk is considered to be greater [Keegan and Diamond 1987: 65]). In addition, lack of isolation also puts this explanation in question (Broodbank and Strasser 1991: 238). Diamond also pointed out that extinction depends on the 'frequency and magnitude of population crashes', and that population turnover tends to be more rapid on small islands (where extinction rates are high) (1977: 257). Diamond identifies two types of strategy in the animal world to cope with extinction: prevention and reversal through recolonisation. Old colonists tend to focus on prevention, by selecting stable or extensive habitats where extinction is unlikely to occur. Expanding colonists, which have high dispersal rates, tend to occupy small and unstable habitats, 'recolonising as extinctions occur' (1977: 257).

It is not hard to see how human colonisers may have developed similar strategies, although in the case of 'social species' different elements come into play. For example, 'the mechanism of local extinction may not be the death of the last individual but instead a conscious abandonment of a territory when the territory or the population is perceived as too small' (Diamond 1977: 257). Teitelbaum and Winter (1985) make a similar distinction between objective and subjective population decline: 'population decline may range from an objective decline in the aggregate size of a population, in growth and fertility, to a decline in the desired or expected family size, in certain age groups or cohorts' (e.g. young to old people ratio) (1985: 11). They also defined population decline in terms of a drop in attributes associated with a growing population (such as innovation, mobility, risk-taking and optimism) (cf. Diamond's 'expanding colonists'), as opposed to those associated with an ageing population (such as conservatism, immobility, risk-aversion, and pessimism) (cf. Diamond's 'old colonists') (*ibid.*). Demographic studies should thus take into account ethnographic evidence, since this is likely to shed light on culture-specific relationships between community perception of stability and actual population size.

Williamson and Sabath pointed out that islanders are likely to be aware of the fact that very small populations are unstable, and this may affect their settlement choices, e.g. by avoiding islands that can support only small populations (1984: 22). Robb and Van Hove (2003: 241) pointed out that humans' decisions are influenced by 'perception, symbolism, and social relations', which in turn affect the 'objective conditions of existence (Bourdieu 1977)'. Childe (1956) also claimed that human beings never adapt to the real world, but rather to the world as they perceive it to be due to cultural conditioning, and Williamson and Sabath emphasised that 'predictive models, generating particular population numbers from environmental variables, must incorporate environment perceptions within a particular cultural framework' (1984: 27).

The following examples will serve to clarify this point further. Cawte (1978) discussed psychological aspects of extinction and survival of two Aboriginal societies living on small adjacent islands off the coast of Australia. The inhabitants of one of the islands were 'gripped by Malthusian forces of famine, disease, and warfare' and had to be evacuated to the larger island, where 'they were literally nursed, fed, and calmed into survival' (Cawte 1978: 99). What Cawte saw and what emerged from interviews with the survivors revealed some interesting differences between the ways the people themselves defined the problem and the way outside observers saw it (1978: 102). The former defined the problem in terms of a shortage of sexual partners, which had led to a state of chronic warfare on the island ('cognised' stress factors), whilst the observers (including the inhabitants of the nearby larger island) saw the stress as the result of famine, caused by the prolonged drought ('operational' factors) (1978: 117). What the study effectively highlights is that if the operational stress factors are wrongly 'cognised', chances of survival are slim. Cawte pointed out that risk can be aggravated when 'institutionalised buffers', which people rely on as coping responses, are mistakenly perceived as adequate to deal with problems (1978: 95). It is only when these buffers are no longer perceived as adequate that operational (e.g. ecological) stress becomes psychological stress, and action is finally taken (*ibid.*).

In another case study, Graves and Graves (1976) spent time studying the contemporary island community of Aitutaki in the Cook Islands. The inhabitants unanimously claimed that life on the island had become 'less rewarding and less fun', mainly because the amount of work required to provide for an average family had increased (Graves and Graves 1976: 448). The inhabitants attributed this to out-migration and consequent increased workload. However, the study revealed how the demographic structure of the population had remained the same. The externally observed cause for unhappiness appeared to be that people had become increasingly involved in wage-labour employment. This had reduced the time available for other traditional activities, such as fishing, planting, and co-operative community activities, and increased dependence on expensive imported foods, so that the financial burden of maintaining children and the elderly was growing. Graves and Graves saw the long-term solution to the growing burden of dependent children not in reduced migration (as seen by the people of Aitutaki) but rather in reduced fertility (1976: 459).

Perception can act at different levels in society. In her study of three Greek islands during the 1941-43 famine, Hionidou noted that social order was maintained on all the islands, but while virtually nobody left Syros and Mykonos, Chios was practically abandoned (2002: 66). The Greek famine, which was caused by the German, Bulgarian, and Italian occupying armies and by the temporary blockade exercised by Allied forces, had its most devastating effect on the islands: 8% of the population of Hydra and Hermoupolis (Syros) died of starvation; mortality increased by almost five times on Lesbos (1,400 deaths in 1942 compared to 390 in 1939), and by more than ten times on Mykonos (Hionidou 1996; Kolodny 1974; King and Kolodny 2001: 242). It is interesting to note that, unlike the people of Chios, those of Syros and Mykonos stayed on in spite of imminent predictable death (departure was made difficult because some of the islands were patrolled by the German military). Although this does not have an obvious prehistoric parallel, other contingent factors may have played similar roles.

Conversely, the inhabitants of the Aleutian Islands displayed great adaptability. The islands, which stretch northward for 1,600 km beyond the Alaska peninsula, separating the Bering Sea from the North Pacific Ocean, are among 'the most isolated islands in the world' (McCartney and Veltre 1999). They comprise a group of ca. 100 islands, which have been occupied for at least the last 8,000 years (1999: 507). Aleuts lived in extreme environmental conditions, including extreme isolation, volcanic eruptions, seismic activity, tsunamis, frequent storms, rough seas, gale-force winds, frequent fog and precipitation, while relying on an exclusively marine diet due to the lack of terrestrial fauna (*ibid.*). Only a few foxes and lemmings live on the islands, and caribou and bear are only found on the Alaskan peninsula and on the island of Unimak, which is the closest to the mainland (McCartney and Veltre 1999: 512). In spite of these extreme conditions, the islands supported a large population during late prehistoric times, estimated at 12,000-15,000 people (McCartney and Veltre 1999: 503). The Aleuts developed a complex strategy for coping with the harsh environment. The rich coastal economy was the key element in sustaining population in the long term, island size and elevation probably being irrelevant to choice of settlement compared to the coastal environment (*ibid*; cf. Anderson [2001] on the southern Pacific islands). This strategy included the 'development of large coastal sites, semi-subterranean houses, tailored warm and waterproof clothing, sophisticated skin boats, utilisation of a broad set of marine foods and raw materials, food storage, fuel for heating and cooking, and refuge islets or rocks for protection against raids' (McCartney and Veltre 1999: 503). McCartney and Veltre also point out that because the archipelago is 1,600 km long, local changes, whether sudden or gradual, would have affected one or more villages (e.g. resulting in their abandonment) but not the entire chain, thus overall longevity could be ensured (1999: 512).

The examples discussed illustrate that in some cases abandonment can be considered to be a form of cultural adaptation. As a common response to extreme conditions, it can be incorporated within a cultural framework, and implemented as a strategy or even as a precautionary measure. Vernicos (1987) noted that present-day islanders in the Mediterranean appear to concentrate their efforts on maximising short-term benefits and on minimising the effects of catastrophic disruptions in the long term. This is because, having experienced sudden disasters in the past, they believe that 'nature and the world's evolution may do their worst to them' (1987: 103). Unfortunately, such a strategy, inevitably based on a subjective interpretation of reality, acts as a 'self-fulfilling forecast', with short-term gain undermining the capacity to overcome critical events (*ibid.*).

The fact that 'small populations do not behave in the same way as large statistical aggregates' (Kunstadter 1972: 315) may result from the contrast between objective conditions and their subjective interpretation. In spite of this unpredictability, demographic studies are characterised by a certain degree of generalisation, since so many factors need to be taken into consideration. Morgan (1974) calculated that, under closed conditions and with no incest prohibition, large founding populations (n=200) survived almost twice as long as small ones (n=100). Cultural aspects, however, make calculating minimum population sizes, or population growth (in terms of time required to achieve a certain size), harder, particularly for prehistoric populations. Risk of extinction, for example, seems to be more related to high mortality and high fertility levels than to the opposite (Morgan 1974), and to be increased by certain cultural variables (e.g. incest prohibition and monogamy) only with decreasing size of founding groups (McArthur *et al.* 1976: 314).

A brief overview of some classic demographic studies illustrates the difficulties encountered by palaeodemographers, which are due to the wide range of variables that need attention. Zubrow's (1975) model has four components: a 'population growth function', a 'population resource check' (which matches population growth to resource availability), a 'settlement locator' (which determines where a new settlement will exist), and a 'longevity function' (which takes into account reasons other than resources). Black's study considered the child dependency ratio, the juvenile/adult ratio, and divergence from stable population (i.e. it compared observed and expected age distribution in a stable population) (1978: 70). Black calculated these indices for the communities of the Pacific outlier islands, and his results suggested that local extinction there would be a rare event, since population could be replenished (*ibid.*).

Williamson and Sabath's treatise considered three variables: island carrying capacity, frequency and amplitude of resource variation, and net costs of contact and exchange between population units (1984: 21). Teitelbaum and Winter (1985: 3-4) considered the combined impacts of births, deaths, immigration, and out-migration, and concluded that discussions of population trends should be based not just on fertility decline but also on mortality trends and net immigration (1985: 5). They then related the number of births, deaths, in-migrants, and out-migrants to a denominator (usually the size of the population producing the stated number of births, deaths, etc.), in order to compare populations of different sizes (*ibid.*). Williamson and Sabath (1984) explained demographic extinction by variations in age structure and sex ratio. While variations in these are normal, they tend to affect fertility levels more as population size decreases (1984: 23). At the same time, other factors (especially social ties) have an effect: in the case of shortage of resources, extinction probability can be lowered by contact, abandonment of islands that lack resources, and migration. These interactions, however, can reduce extinction probabilities only if islands display differences in their population age, sex structure, and resources (*ibid.*).

Prehistoric Demography

Studies of prehistoric demography have focused on two general bodies of data: evidence from human skeletons and studies of prehistoric settlements. Dumond (1997) claims that, although skeletons provide a good indication of fertility, population growth is mainly affected by mortality and migration, and that, accordingly, cemetery studies and regional settlement studies must be combined (e.g. Belfer-Cohen *et al.* 1991). Settlement studies have attempted to identify cross-cultural patterns in 'population to roofed-over space' (Naroll 1962), or 'floor space *per capita*' (Longacre 1976) ratios. However, Paine points out that such ratios are highly culture-specific, and should thus be estimated through ethnographic analogy (1997: 5). In dealing with settlements, we are also confronted with the problem of establishing contemporaneity. In his study of the Cycladic islands, Broodbank mentions that 'even the most general trends probably did not operate synchronously or at the same rate throughout the islands' (2000: 88). Archaeologists are often forced to rely on ceramic phasing for establishing chronology, but Paine points out that 'such phases may exceed the life of the structures or rooms used to estimate demographic parameters' (1997: 6). Detailed chronologies, on the other hand, are necessary, since they can reveal a complex pattern of human spatial distribution, highlighting the fact that demographic collapse is not always sudden or rapid, but closely related to the 'heterogeneity of abandonment risk', which is based on local conditions (Paine 1997: 3).

Most working hypotheses used by demographers are based on simplified models of reality (e.g. Graber 1997: 263), and even age and sex determinations may be inaccurate, as they often rely on identifications made by different researchers, or, as pointed out by Belfer-Cohen *et al.*, can be affected by biases in the investigation (1991: 412). These generalisations should always be checked, and in our case we should ask whether islands in fact provide representative case studies for the development of human populations. Demographic studies of contemporary societies are riddled with difficulties, but palaeodemography has the obvious added difficulty of dealing with the past. However, at a higher level of generality, useful predictions about some processes replicated on different islands can be made.

Alesan *et al.* (1999) reconstructed the mortality pattern of the population buried in the Iron Age cemetery of S'Illot des Porros (Mallorca, Spain). Low life expectancy, high infant mortality, and hard life conditions were inferred from the data (Alesan *et al.* 1999: 285). Some assumptions were necessary to carry out the study, in order to take the skeletal population as representative of the living community: it was assumed that the cemetery was used just by one group, that there was no other cemetery in use at the same time, that all the members of the community were buried there, that the record was complete, and finally that births balanced deaths, i.e. that throughout the use of the cemetery the population was characterised by zero growth (which Acsádi and Nemeskéri 1970 consider typical for ancient populations) (Alesan *et al.* 1999: 288). The mortality data were then compared with three population models: Ledermann (1969), Coale and Demeny (1966), and Weiss (1973). After comparison of the cemetery with these three models, three biases were observed in the data: first, in the under-representation of infants under the age of five; second, in the excess of subadults between the ages of 5 and 20; third, in the deficit in old age people (Alesan *et al.* 1999: 292-3). However, the mortality pattern conformed to all the models consulted: infant mortality was particularly high between birth and 5, it was low between the ages of 5 and 15 (and minimum at 10-14), and it increased again from 15 onwards (Alesan *et al.* 1999: 296). Average life expectancy was close to 23 years (1999: 300). Alesan *et al.* were able to conclude that this was a 'young population under hard life conditions' (*ibid.*).

There are two main problems in the reconstruction of past populations: the representativeness of archaeological samples, and sex and age attribution (Alesan *et al.* 1999: 286). Both Paine (1997) and Keckler (1997) point out that while many palaeodemographers assume that long-term population growth rate in the past must have been very close to zero (Hassan 1975), the mortuary data of archaeological populations seem to contradict this. Keckler proposes an alternative explanation: that 'long periods of growth were interspersed by acute crashes' (1997: 205). On the basis of the work of Malthus (1960 [1798]), Kunstadter also claims that the normal condition is population growth (1972: 348). Leigh (1981) suggested that, given static technology and culture, an island's carrying capacity fluctuates around average values for a long time. Leigh calculated that, while catastrophes do cause short-term fluctuations, carrying capacity should return to pre-catastrophe mean levels unless large land areas are lost (1981: 235), and concluded that populations appear to fluctuate primarily in response to environmental change (1981: 234).

Modelling past population growth is not straightforward, as several factors may have a delayed effect. For example, populations tend to carry on growing long after fertility levels have declined (Teitelbaum and Winter 1985: 8). This effect, called 'demographic momentum', results from the fact that several young females will be reaching reproductive age for a long time after the fertility decline (*ibid.*). This means that population fluctuations can be diluted over long time periods, and has the important implication that populations may have enough time to recover. Indeed, historical data from Pitcairn and Norfolk indicate that some families managed to survive in the long term (Anderson 2001: 21).

Estimating Minimum Populations

McArthur *et al.* (1976) attempted to calculate the minimum number of people involved in the settlement of Polynesia by modelling the dynamics of three population categories: those heading for extinction, those with presumed success, and 'doubtfuls'. The study observed that the probability of extinction increased with the age of the initial group and as its size diminished. Even though a constant cultural pattern of monogamy and marriage was assumed, and no incest, the model indicated such variability in growth patterns (1976: 318) that the researchers concluded that 'there can be no universal minimum size for small population isolates' (1976: 324-5). They also determined that the time required to reach a specified size or the time people actually survive before they die out is also highly variable (*ibid.*). They concluded that variation was such that 'extrapolation backwards from some particular number to try to establish either the size of the initial group, or the time depth of settlement, would clearly be futile' (McArthur *et al.* 1976: 322).

Faced with these conclusions, it would seem at first sight difficult if not impossible to draw any conclusions from population data, since so many factors can affect objective numbers and their perception. However, some valid generalisations are still possible. Broodbank and Strasser (1991) estimated the minimum number of early farmers and their domesticates involved in a single planned (and successful) colonisation event (in this case, the island of Crete). They also pointed out that these estimates would depend on the 'safe size' perceived by Neolithic colonists (Broodbank and Strasser 1991: 240). Survey data indicate that the basic settlement unit in the Aegean Early Neolithic is 'the small village of between 40 and 200+ inhabitants', and it therefore seems reasonable that this figure (a minimum group size of 40) reflects this 'safe size' (*ibid.*). Williamson and Sabath also claimed that in the Marshall Islands (though not in the whole of the Pacific islands), atoll colonisation would include an 'organised procedure' (1984: 32). This organisation would involve 'many settlers' using horticulture and possessing a maritime technology that would ensure contact with another population source (*ibid.*).

In general, studies on minimum island population sizes (e.g. McArthur *et al.* 1976; Broodbank 2000: 86) tend to emphasise that numbers would have been small. In the case of islands, this would partly be due to the difficulties posed by maritime crossing. This smallness, as we saw, carries several implications and consequences, since chances of extinction increase as population size diminishes (Pielou 1969). Williamson and Sabath (1984) have argued that communication and exchange would have been fundamental means of survival for oceanic cultures characterised by small population sizes. Communication and exchange can be considered as cultural variants of the 'commuter' and 'rescue' effects of island biogeography (i.e. the replenishing effect of immigration on extinction), which tend to privilege islands that are close to sources of dispersing species (Brown and Kodric-Brown 1977: 445-446).

Within the context of early Cycladic Prehistory, Broodbank also pointed out that 'variability in settlement size is about degrees of smallness' (2000: 86). Typical values for EBA settlement density were calculated by Cherry (1979: 37-43; Wagstaff and Cherry 1982: 137-8) as being 0.5-1.5/sq km and double that in EBII (1.5-3.0/sq km). On the basis of these densities, Broodbank tabulated the population for each Cycladic island (2000: 90) and observed that while overall Cycladic population reached a few thousands only a few islands had populations of 300-500 people at any one time. Populations below this figure cannot exist as closed communities (i.e. under endogamy) (Adams and Kasakoff 1976; Williamson and Sabath 1984; Wobst 1974). Broodbank noted that at the lowest density levels (0.5/sq km), no island could support a self-sufficient population, and therefore concluded that 'a virtually ceaseless movement between individuals, communities and islands' would have been necessary to ensure the survival of these island communities (Broodbank 2000: 89). Exogamy and exchange could protect these communities, but not every community would benefit from the Cycladic interaction network to the same degree (Broodbank 2000: 87), with the effect that the smaller settlements (particularly those between 5-10 people and 11-50 people) would have a tendency 'to wink on and off in the landscape' (2000: 89).

Small population sizes have another important effect, with regard to the resources used up by individual communities: small numbers of people can subsist on fewer resources and on limited amounts of arable land. On the basis of data from Halstead (1981: 317-18) and Gallant (1991: 82-7), Broodbank indicates that an individual family could live on 3-6 hectares of land, and by extension, that a large village would require a few square kilometres (2000: 86). This implied that people's impact on the environment would have been low, and if local resources were ever exhausted, sites could be relocated without too much difficulty. On the other hand, if a community occupied a favourable location, this might lead to population build-up (Broodbank 2000: 87). A good understanding of the palaeoenvironment is therefore necessary to identify what options would have been available to early travellers and settlers. Graber maintains that growing populations tend to 'expand rather than intensify, intensify rather than import, and import rather than suffer nutritional decline' (1997: 263-67). In the Cyclades, Broodbank also highlights a general tendency to fission rather than nucleate, as demonstrated through the data from both cemeteries and settlements (particularly on Melos, Naxos, Erimonisia, Amorgos, Ios, and Syros) (2000: 87). Fissioning and dispersal can protect the overall population in the long term, but expose individual groups relocating to new areas to several risks, particularly if they are far away from the founding population (Broodbank 2000: 87). Therefore, while dispersal remains a possibility, risk can be solved in different ways, also depending on people's subsistence strategies and their location. In the case of farming communities, these strategies include not just increased mobility but also changes in crops, using wild resources, increasing reserves for times of hardship, and developing exchange networks (Cherry 1981: 60, 1985: 20) (in Broodbank 2000: 81).

Estimating Island Carrying Capacity

Both the minimum size of initial founding groups and the carrying capacity of an island are influenced by cultural factors. Sanders defined carrying capacity as 'simply the amount of land necessary to maintain a given economy, under specified environmental conditions, with a particular strategy of land use' (1997: 383). Carrying capacity is thus not an absolute value, but rather a 'shifting scale' (Sanders 1997: 383; cf. Robb and Van Hove 2003). Kunstadter has pointed out that while resources are often considered to pose limits on settlement size and density, in reality they do not limit population growth automatically, since this can expand beyond 'the maximum supported by food production' (1972: 322). However, Williamson and Sabath argue that there is a maximum sustainable density for any human population, which ultimately depends on age-specific birth, death, immigration, and emigration rates, as well as social mechanisms (1984: 32).

Calculating carrying capacity is useful for explaining why groups select different strategies and then modify these, either by changing location or by intensifying land production if moving is impossible (Graber 1997; Sanders 1997). Hence, perhaps optimistically, Sanders claims that 'the calculation of carrying capacity does provide us with a model to predict *future* changes' (1997: 383, emphasis added). For the purposes of this study, it would be useful if estimating carrying capacity could give us at least an indication of past changes. A good starting point is to consider different land use strategies that are used to calculate carrying capacity. In the case of hunter-gatherers, resources are usually considered to determine directly the size and location of camps. Perlman, however, points out that this approach treats foraging groups as 'closed systems', and ignores external and cultural factors (1985: 33). Instead, he argues that hunter-gatherer behaviour should be studied both in stable and in changing environments, since mobility and sedentism are determined by different variables (resources, but also catchment shape, and more importantly, the availability of mates for reproduction) (1985: 40). According to Wobst (1976), a group of 100 people can provide 80% of its own mates, while to reach 100% (complete endogamy) numbers must be in the 300-500 region. These numbers are very high even for extant hunter-gatherers: at the highest documented population densities (e.g. 1 person per square mile or ca. 2 persons per 5 km sq.), groups would be between 100 and 300 people, meaning that completely closed mating systems are highly unlikely (Perlman 1985: 42).

Williamson and Sabath (1984) also developed a model based on carrying capacity and linked it to settlement. Their study drew upon previous work by Hainline (1964, 1965) in the Mariana, Caroline, Gilbert, and Marshall Islands. Hainline noted a significant relationship between island area and population size, and between land area and population size for islands experiencing drought. In simple terms, Williamson and Sabath devised a method for estimating an island's carrying capacity from quantifiable variables, and predicted settlement of all islands with high carrying capacity. The conditions necessary to test the hypothesis were to ensure that extinction probabilities could be linked only to variations in the island carrying capacity. They selected the Marshall Islands (29 atolls and 5 coral islands), of which 10 were traditionally unsettled (Williamson and Sabath 1982, 1984), because they complied with important prerequisites: they displayed a unitary culture, which had remained unchanged for many generations; they included both settled and unsettled islands, with similar resource fluctuations; and inter-island contact costs were considered to be equal (1984: 25). They claimed that differences in island settlement were unrelated to geographic isolation or differences in resources, as both inter-island contact cost and resource fluctuation throughout the archipelago were considered to be even (*ibid.*). In contrast, they found a strong statistical association between Marshall atoll population size and atoll 'Mesophytic Index' (MI=mean annual rainfall x atoll land area) (1984: 27). This is because of the strong relationship between MI and staple crop production area, which in turn supports increasing population sizes (*ibid.*). The MIs of inhabited and uninhabited atolls were thus compared in order to establish if there is a threshold MI value that determines settlement. The conclusion was that, overall, all uninhabited atolls have either low rainfall or small land area, or both (1984: 28).

Williamson and Sabath stress however that the statistical link between population size and mesophytic index is not necessarily a direct causal relationship. Variation in the data indicated that although population size in the Marshall Islands was linked to specific environmental factors, the latter were 'socially mediated' (1982: 82). Overall, they noted that the people of the Marshall Islands decided not to maintain permanent settlement on 'islands that would support less than 40-80 people' (1984: 28). Williamson and Sabath noted that this value is much lower than that chosen by Bass Strait islanders, who decided to abandon areas too small to support populations of less than 300-450 people (Jones 1977; Lampert 1977, 1982), (i.e. more or less a closed unit, according to Wobst [1976]), and suggested that these differences could be due to variation in maritime technology (1984: 31).

Robb and Van Hove (2003) carried out a study in order to estimate Early Neolithic population levels in southern Italy. They analysed different types of Neolithic subsistence strategies and concluded that variation was such that it was impossible to come up with a 'single-best fitting model for Neolithic economies' (2003: 250). They began by estimating the resources needed annually by a group of 50 people relying mainly on grain. These were calculated as being in the order of 10-15 ha of active grain plots, plus some fallow fields and small gardens (2003: 246). The calculations were based on Gregg's (1988) estimate of the requirements of a family (4-6 people) living on grain (calculated as ca. 1000 kg/yr), and on a combination of Jarman and Webley's (1975), Halstead's (1981), Barker's (1985), and Gregg's (1988) estimates of Neolithic grain yields (which averaged between 500 and 1000 kg/ha). Robb and Van Hove's estimate of 10-15 ha for southern Italy (2003: 246) compares positively with that of Broodbank's for the Cyclades (2000: 86), since Robb and Van Hove's slightly higher figures include additional fields and fallow lands.

Robb and Van Hove also estimated population and land figures for 20 other types of subsistence, both for their study area and for other regions (2003: 247-8). According to their analysis, Lipari hardly ever achieved demographic self-sufficiency, and it is unlikely that Malta had more than a few thousand inhabitants in the Neolithic (2003: 252). Nonetheless, they calculate that land was sufficiently available on these islands for different purposes, even if subsistence was solely based on agriculture, as plots could be scattered (particularly in hilly environments) (2003: 250). This would also reduce the effects on soil exhaustion and erosion (2003: 251), a point which is supported by Grove and Rackham, who claim that Mediterranean ploughing started to really pose a problem (in terms of causing erosion) only in the 19th century AD (2001: 290). The resulting conclusion is that since small populations can subsist on small amounts of land (e.g. islands), provided that they are in contact with other communities, low population numbers (unless very low) should not cause land abandonment. Other explanations should therefore be sought to account for it.

Robb and Van Hove (2003) point out that Italian Final Neolithic and Copper Age communities are often thought to have relied increasingly on pastoralism compared to earlier Neolithic ones. As animal herding requires more space than agriculture, they explain that this would result in a decrease in overall population density (unless there was a contemporary increase in population, which they discount) (2003: 252). Robb and Van Hove suggest that the apparent late Neolithic 'abandonment' of the Tavoliere plain in SE Italy (Tinè 1983) may in fact result from such decrease and from population movement from the Tavoliere plain towards the mountainous Gargano area, where slopes could be used for herding. This shift would be the 'result of social choice' rather than demographic pressure, which they claim would lead to intensifying the existing grain agriculture rather than to increasing the range of herding (2003: 252).

In Robb and Van Hove's (2003) model, areas were abandoned as a result of a change within an established practice (within farming, a shift from crops to small-scale pastoralism). However, it is also possible that this 'social choice' was in part a response to environmental change, as the area became arid in the Late Neolithic (Caldara *et al.* 2002: 127) (see Chapter 2), possibly preventing the intensification of agriculture. A similar argument was made by Stone (1993), who compared 'agricultural abandonment' among Nigerian farmers and seventeenth-century pioneers in the eastern United States, and interpreted it in both cases as an adaptive response to declining agricultural yields.

The Cultural Factor

The previous sections have presented the functionalist emphasis prevalent in abandonment studies. Although many researchers hypothesise how past communities culturally mediated environmental factors and demographic processes, in reality less attention has been paid to the cultural mechanisms that people use to negotiate their environments. Archaeologists recognise that elements beyond their grasp are potentially responsible for the 'noise' in the models and that the variations responsible for this disturbance tend to be culture-specific. However, there has been a general reluctance to deal specifically or directly with cultural factors, with the result that concepts such as the 'push' or 'pull' factors (Anthony 1997) (e.g. the difficulties encountered at home and the attraction of mainlands or bigger islands) are often articulated in biogeographical terms, rather than in terms of perceived opportunities.

While archaeologists are cautious in dealing with cultural issues relating to the past through proxy indicators, anthropologists have first-hand access to living communities and are thus able to investigate these factors, or the role of cultural and social factors in causation. They are thus able to explain people's responses to the environment in terms of different cultural strategies (e.g. prevention, reversal, innovation, but also optimism, pessimism, apathy, resilience, traditionalism, popular wisdom, conservativism, and so on). These can be studied at a local and comparative level because they display a degree of regularity, as people establish routines, traditions, and strategies (Hoffman and Oliver-Smith 1999: 3) or, in modern terms, 'cultures of response' (Hoffman 1999: 134; Dyer and McGoodwin 1999: 226; Dyer 1999: 278).

Measuring the impact of cultural factors in processes in the past is at first sight less than straightforward. As with colonisation (Chapter 3), different pull factors or preferences may be partly responsible for triggering movement, which may result in abandonment. Communities (and individual people within them) deal with problems differently, depending on their means but also on their cultural background, and on those bases will either select abandonment or opt to stay put. In the case of the prehistoric Mediterranean islands, ecological and demographic factors may have been dominant in early island life, but by the Bronze and Iron Ages cultural/social factors might have acquired more prominence. As the allure of potential alternatives became more marked and changes in technology made it easier to pursue these alternatives further, increased knowledge of such possibilities may have lowered the 'threshold of resistance to push factors' at home (such as population pressure, disease, social inequality, and so on) encouraging people to move (Rockman 2003: 9). Thus, when thinking of abandonment, it is worth remembering that the pull of the mainland may be responsible for why people leave islands. 'There is always a mainland' (Renfrew 2004: 283), as humans mentally and physically scan their surroundings and identify 'mainlands' at different scales, be they real, another large island, or another land that satisfies the criteria desired at the time.

The study of a selected group of islands in the following chapter attempts a reading of their occupational histories in different keys, by reviewing a whole spectrum of factors, some ecological and biogeographical, others less archaeologically visible or measurable. The latter are likely to account in part for the decision to abandon areas that were previously occupied or used, but also for the resolution to stay in spite of difficulties. If specific local resources were present, their acquisition and control may have allowed communities to participate in wider networks, compensating for the risks involved in any prolonged stay in an inhospitable environment. At the same time, cultural elements may be responsible for the ways in which communities react under stress, fragmenting or coalescing at different times, leaving or staying behind. Both the 'environmental and social location' (Oliver-Smith 1999: 24) of the processes under study must be considered if we are fully to appreciate how such decisions were reached.

CONCLUSIONS

There is no simple answer to the question posed at the start of this chapter ("what is abandonment?"). The review of theories and case studies emphasises that abandonment is to be understood as an aspect of a process, of which movement, migration, colonisation, and settlement are but a few facets. What emerges from the studies is that movement is inherent in most cultural systems and that abandonment is 'a *normal* process of settlement' (Cameron 1993: 3, emphasis added). Understanding the heterogeneous nature of this process is important, since each facet sheds light on another:

understanding abandonment ultimately clarifies certain aspects of colonisation, and vice versa, this mental process revealing them both to us as fundamental components of a cyclical process. Abandonment can perhaps be best assimilated to some form of cultural transformation akin to discontinuity, which may be permanent, temporary, anticipated, or sudden (at least in appearance). However, even when viewed as a form of discontinuity, abandonment remains very much a constant of human social history, as it is part of a process of transformation fuelled by human adaptation and self-reinvention, elusively evading fixed definitions.

Schiffer's definition of abandonment as an S-A process is just one of many possible descriptions, useful in some respects, but not in others, since the S-A boundary is not fixed. Abandonment is perhaps more easily understood in the systemic sphere of interaction (cf. the abandonment of Mediterranean islands in the present); however we must also seek to understand it in the archaeological sphere. We should aim to understand both its causes and effects, and constantly question what we mean by it (since time-scales are relative, when is abandonment 'definitive'?) (cf. Tomka and Stevenson 1993: 192).

If we agree that abandonment is part of a process of cultural transformation, and therefore does not necessarily represent an 'end', then increasingly all-encompassing solutions become necessary. For this reason, and because few texts deal with abandonment explicitly, an underlying intention of this review was not to exclude any line of argument that has been used either directly or indirectly to study abandonment. It clearly emerged that studies can provide general ideas, but not local solutions, and this will become evident in the following chapter, which deals with the data from individual Mediterranean islands.

The studies reviewed, as we saw, share some common concerns: environmental changes can be considered as a constant in the long run (both geographical and temporal), but localised changes had a considerable effect in the short term (c.f. Schlanger and Wilhusen 1993). Regional archaeological studies have tended to link abandonment to larger environmental and sometimes social processes. In some cases, abandonment has been interpreted effectively by using a core-periphery model (Lillios

1993, Weisler 1995). However, such a large-scale approach can be misleading, and risks remaining in 'an immature phase of prime-mover models' (Lillios 1993: 118). Stone has claimed that these grand models are 'built on perfectly isotropic, ahistorical plains populated by perfectly rational, knowledgeable people' (1993: 75).

Important factors may be acting on the local scale. These, as we saw, include subtle differences in the non-reciprocal nature of the dependence of communities (with some more reliant on others) (cf. the Cyclades), or the fact that peripheries can suffer the effects of centre decline (cf. Henderson and Mangareva). Demographic studies can sometimes pick out these factors, by highlighting human responses and solutions to situations that may arise locally. Tomka and Stevenson have attempted to address the imbalance between different scales of enquiry in abandonment studies by claiming that, although several studies display cross-cultural similarities indicating that 'processes of abandonment are not culture or region specific', the local context provides the key to identifying the factors which characterise different abandonment processes (1993: 191).

Braudel wrote that 'the fate of many Mediterranean islands was a precarious, restricted, and threatened life' (1972: 154). This is certainly true for the historical period, which, as we saw, was often bleak for the islands, which suffered famines, epidemics, and pirate incursions. However, we should reject the hypothesis of 'insular fatality', since, as King and Kolodny claim, 'islands in the Mediterranean are not subject to deterministic fates just because of their island status' (2001: 257). In some ways, abandonment is a strategy of survival, a peripatetic and opportunistic strategy, as exemplified by the abandonment of Mediterranean islands in the present day: quite simply, if abandonment did not work as a strategy, in terms of moving on physically and sometimes mentally, other solutions would have been selected instead.

The present-day Mediterranean has been interpreted as a 'border region', which is 'closed to immigration and citizenship but open to trade, ideas and languages, and in an asymmetrical relationship which remains a permanent source of tension' between officially-European and non-European people (Foucher 1998: 236). Different mechanisms operated in prehistory to create a whole different set of 'asymmetrical relationships'. These differences ensured community survival as opportunities could be seized and backwaters left behind. In this respect, the prehistoric abandonment of Mediterranean islands can offer us a unique insight into people's changing perception of their environment over time.

It is therefore on people (and their relation to the environment) that we should be focusing. But does demography simplify or complicate things for us? As Alesan *et al.* put it, 'the validity of palaeodemographic studies cannot be judged *a priori*: the quality of the data and of the analysis are the factors which require evaluation in each palaeodemographic study' (1999: 300). A palaeodemographic reconstruction of all Mediterranean islands is beyond the scope of this thesis, and may even be simply beyond reach, judging by the reservations expressed by so many researchers (and most recently by Osborne [2004: 170]). Reconstructing the palaeodemography of individual islands, particularly those that were abandoned, can be attempted only with a large degree of generalisation and by relying on a number of assumptions: for one thing, data are scant and, where available, mortuary data are usually over-represented in the archaeological record of most islands, while there is a distinctive lack of settlement data. To this we must add the fact, exemplified in some of the studies reviewed, that statistical tests cannot prove there is necessarily a causal relation between demographic data and other factors considered.

With this caveat, some relational observations will be made in the following chapter, in order to see if islands that were abandoned share certain characteristics. Once a relational link is established, its causal validity can be investigated, opening up the way to further questions when more data become available. The results of the abandonment data analysis in the next chapter, like all archaeological research, are therefore provisional, but no less valid for that matter. Whether these relationships are of a causal nature will be addressed in the light of what we know now. As more data become available, it may be possible or necessary to ask a whole set of different questions and provide new answers, potentially enriching our investigations by including previously less archaeologically-visible factors.

CHAPTER 7

THE ANALYSIS OF ABANDONMENT AND RECOLONISATION DATA: RECONSTRUCTING ISLAND HISTORIES THROUGH SELECTED CASE STUDIES

METHODOLOGY

This chapter investigates Mediterranean island abandonment and recolonisation through the application of a tailor-made methodology to a series of case studies. The methodology has been formulated on the basis of the theoretical approaches discussed in the previous chapter. The main criterion for selecting the case studies is extensive archaeological investigation of the islands in question. A well-established archaeological record is fundamental as only in this case can breaks in the evidence be reasonably securely attributed to instances of abandonment rather than to lack of research. 'Extensive archaeological investigation' is defined as 'the excavation of a multi-period site and/or field survey of a considerable part of the island' (corresponding to Broodbank's 'good' level of exploration category [2000: 52]), as these criteria make the study of abandonment applicable at different spatial scales. There is a clear imbalance in the amount of work carried out on islands in the past fifty years, with - for example - some of the Aegean islands more thoroughly surveyed than most of the western Mediterranean islands. However, in recent times a better balance is starting to be achieved, particularly through the efforts of joint international survey teams. Elsewhere, individual sites (e.g. the Lìpari acropolis) still provide the main chronology, which is increasingly being refined. Another criterion for inclusion in the study is physical diversity across the sample, defined here in terms of a wide range of geographical characteristics (size, distance, altitude, geology, resources, water availability, etc.). The inclusion of physical attributes is not biased towards islands that are 'expected' to support continuous inhabitation or otherwise.

As a first step, each island is regarded as a distinct unit of study: this is done through a brief description of the island's physical characteristics and a reconstruction of its settlement chronology. The presence of gaps in the chronology is then assessed and investigated by questioning whether the breaks can be taken to represent abandonment. If this is the case, the study explores the nature of the abandonment further (e.g. is it at the level of an individual settlement or is the whole island abandoned?). Subsequently, possible causes for abandonment are reconstructed by looking at the series of variables singled out in Chapter 6. The next step in the investigation is to look at abandonment on a comparative scale, in order to ascertain the relative/absolute importance of different factors (e.g. size, distance, and resources). The islands' occupational trajectories are then addressed in the light of physical similarities and differences, i.e. whether there are meaningful associations between certain biogeographical characteristics on the one hand, and settlement continuity and abandonment on the other.

The following islands will be studied in detail: Kythera (south of the Peloponnese); Melos, Kea and Naxos (Cyclades); Cyprus; Palagruža and Hvar (central Dalmatian Islands); Ibiza and Formentera (the Pitiussae Islands); the Aeolian Islands; Malta; Jerba; Pantelleria; Palmarola; and the Tremiti Islands (see Fig. 7.1 and Table 7.1). The sample includes 22 islands (over 10% of the total sample of islands considered in this thesis). They range in size from 0.3 sq km (Palagruža) to 9251 sq km (Cyprus). Seven are smaller than 10 sq km, which in the Pacific is considered to be the minimum acceptable size in terms of ensuring population survival (Keegan and Diamond 1987: 65). In the Mediterranean, it has been suggested that this threshold may be lower (or even irrelevant), because of reduced inter-island distances (Broodbank and Strasser 1991: 238), this value therefore will be tested.

Four islands fall in the 10-50 sq km range, two are between 50-100 sq km, and nine are larger than 100 sq km. Cyprus is much larger than any other island in the sample and clearly - in this case - size, in terms of smallness, can be excluded *a priori* as a variable determining abandonment. Population estimates, in relation to island size and different settlement densities discussed in Chapter 6 (cf. Broodbank 2000: 90), were calculated and tabulated in Table 1. The table indicates that fewer than half the islands could support endogamous populations (ca. 300-500 people) (Wobst 1974; Adams and Kasakoff 1976; Jones 1976; MacCluer and Dyke 1976;

Williamson and Sabath 1984; Broodbank 2000). When population estimates are translated into arable land needs (using figures from Broodbank [2000: 86] and Robb and Van Hove [2003: 246]), it emerges that most islands in the sample would have had sufficient agricultural land: a community of ca. 300-500 people would have required between 50 and 60 ha of (not necessarily continuous) arable land, or 0.6–1.5 sq km, which most islands in the sample could offer. These figures indicate that communities on most of these islands would have been able to survive, in view either of the island's actual size and/or of its proximity to other land. However - as the case studies will demonstrate - this was not always the case.

The following factors were singled out in the previous chapter as playing a role in the abandonment of land, both in general terms and specifically on islands: size, distance, configuration, geology, rainfall, water sources, agricultural land, biodiversity, resources, and catchment areas, as well as human perception of an island's potential for ensuring a community's survival and other cultural variables affecting human behaviour (e.g. the 'pull' effect already discussed in Chapter 6). The variability of the last two factors prevents a 'ticking the box' approach. Nonetheless, since some basic requirements for human survival can be singled out, some guidelines can be offered that might help identify different levels of vulnerability, which in turn lead to assessing degrees of abandonment risk. For example, Wagstaff and Gamble have suggested that islanders' minimum needs would involve food, water, shelter, clothing, fuel, and tools, as well as material for constructing seagoing vessels (1982: 98); therefore access to these resources (on the island or through a network) would have been necessary to ensure survival.

There are several other considerations that prevent us from adopting a 'ticking the box' approach. Broodbank explains that, because of their mountainous nature, there is no direct relationship between island size and arable land in the Cyclades, and that terracing is necessary to farm slopes steeper than 10-15° (2000: 76-7). He also mentions that terracing was probably introduced rather late to the Aegean area, and to most Mediterranean islands for that matter (after the end of the Early Bronze Age, judging from the evidence from the island of Amorgos and from north-west

Kea) (Whitelaw 1998; French and Whitelaw 1999: 173-5) (*ibid.*). This in turn indicates that agricultural exploitation of the islands would have been much more limited in scope before then. There are, however, also some regularities which are useful to this study. In the Cyclades, altitude and ecological zoning are related, as also island area, altitude, and rainfall (mountain rain begins at heights of ca. 600-700 m a.s.l.) (Broodbank 2000: 74, 76, 78; Watson 1964: 16). These relations illustrate that island ecological biodiversity (and indirectly their potential for sustaining human populations) can to an extent be inferred by looking at simple variables (such as size and altitude).

In terms of geology, Mediterranean islands can be divided into two main groups: volcanic and non-volcanic. As already said in Chapter 2, soil type is an important variable in terms of moisture retention potential and the types of vegetation it can sustain (e.g. whether the type of soil allows the roots to access this moisture) (Blondel and Aronson 1999; Grove and Rackham 2001). Semple observed at the start of the 20th century that in the Mediterranean 'the small islands of volcanic origin show the greatest production and hence marked density of population', while in the non-volcanic islands 'geology made life harsher' (1911: 450-1). The Cyclades have mainly non-volcanic soils, with only Thera and Melos being volcanic (Broodbank 2000: 79-80). The Dalmatian Islands have limestone soils (or made of other porous rocks), meaning that they are thin and rocky, and therefore hard to irrigate and plough (King and Kolodny 2001: 240). In historical times, their economy relied on small-scale cereal and vegetable cultivation (including small olive groves and vineyards), on the grazing of sheep and goats, and on maritime activity (*ibid.*). On the other hand, the Aeolian Islands are all volcanic and benefit from fertile soils, which in historical times supported a flourishing wine industry (King and Kolodny 2001: 244).

There are other characteristics which affect all Mediterranean islands, regardless of their size, although the latter mitigates their effects. The effects of drought, heavy rainfall, and fire, for example, have already been discussed in Chapter 2. Human adaptation (from the decision to select animals and plants that require less water to the invention of water-proof mortar for storing water in cisterns) can partially alleviate the harsh conditions induced by these features. There are also physical characteristics that have a beneficial effect on the settlement of islands: these include size and altitude (which, as mentioned, may affect biodiversity and attract mountain rain), the presence of plains and mineral resources, and proximity to other lands. As we shall see, it is likely that the people of Kea (Cyclades) benefited from their proximity to the mainland and particularly to the metal resources of Lavrion, which were exploited as early as the Early Bronze Age (Broodbank 2000: 80). Naxos is not just a large island - it also has mineral resources (emery and marble) (Broodbank 2000: 79, 80). Broodbank observed that 'though climatically and environmentally marginal, the Cyclades are central in terms of their lithic and metallic resources' (2000: 76). The following sections show that certain characteristics (and resources in particular) played an important role in the islands' settlement history at different times. The case studies, and the comparative analysis that follows, will offer a more coherent vision of patterns of human use of the Mediterranean islands.

CASE STUDIES

KYTHERA

Kythera, which lies very close to the Peloponnese (ca. 15 km), has a surface of 280 sq km, a coastal length of 52 km, and a max altitude of 508 m a.s.l. (Fig. 7.2). It has freshwater springs and a rainfall regime of ca. 600 mm/year, but no mineral resources of note. Population estimates for the island on Table 1 show that the island could sustain an endogamous population at a density of just over 1 person per sq km. The island has been the focus of an intensive survey and interdisciplinary project directed by Broodbank and Kiriatzi for the past 5 years (Kythera Island Project, henceforth KIP) (http://www.ucl.ac.uk/kip). The KIP survey, which covered 100 sq km of the island, has highlighted different phases of human development on the island, from its initial settlement during the later Neolithic (5th mill. cal. BC) to the present.

Broodbank pointed out that, because of its size and relatively even surface, the island offered several areas for settlement (1999b: 195), even if occupation was not always continuous at individual sites (1999b: 197). The Aghia Sophia Cave, near the village of Kalamos (SE coast), excavated by Tsaravopoulos in the 1990s, is considered to provide the earliest evidence of human occupation on the island (Papatsaroucha 2000: 11). Finds included a number of Late Neolithic sherds (5th mill. cal. BC, contemporary with Saliagos), some with painted decoration (Papatsaroucha 2000: 12). The earliest material (lithics) found by the KIP survey also dates to the Late Neolithic. No pottery was found for this period on Kythera in the KIP survey area (Broodbank pers. comm. 2003).

The KIP survey demonstrated that human occupation became more established from the Final Neolithic. Choustis Cave, close to Diakofti harbour (one of the few good harbours on the island), also yielded material dating to this period (Final Neolithic or perhaps initial Early Bronze Age) (Papatsaroucha 2000: 12). Obsidian blades appear in the Final Neolithic (possibly introduced via the mainland, rather than directly from Melos). In the Final Neolithic, human occupation on the island is firmly established, at sites where lithics and pottery are found in associated contexts dated to this period. Occupation lasted until 1100 cal. BC (Post-palatial period) (Broodbank pers. comm. 2003). The KIP survey did not find any material following this period and recorded an occupational gap until the 7th c. BC in the survey area. However, material spanning from the Geometric period (8th c. BC) to Roman times has been identified by another survey team in the area of the Polis (Petrocheilos 2003). According to Herrin, there is evidence (coins and pottery sherds) that the area around Kastri was occupied in the 6th and 7th c. AD, although 'it is impossible to prove continuous settlement from the fourth onwards' (Herrin 1972: 43). Kastri was abandoned at the end of the Late Roman period in the mid-7th c. AD (possibly because of Slav incursions) (Herrin 1972: 44). There is no evidence of either Slav or Arab pirates settling for any length of time, and the island was used again in the 10th c. AD as a hunting ground by mainland inhabitants (Herrin 1972: 45). Settlement on the island resumed ca. AD 1100, i.e. the time of Byzantine colonisation (Herrin 1972: 46).

In summary, the settlement evidence from Kythera displays two definite gaps:

1. between ca. 1100 and 800 BC (Polis) or ca. 700 BC (elsewhere)
2. between AD 650 and 1100.

The first gap, which coincides with the period just after the fall of the Mycenaean Palaces on the Greek mainland (Post-palatial period, ca. 1200 BC) and before the rise of Archaic Greece in the Early Iron Age, will be investigated in more detail in the "Data Analysis" section. With regard to the second gap, the KIP survey found no material dated after the end of the Roman period, or relating to the Early Byzantine period (c. late 7th to 10th centuries AD). This lack of material is supported by Byzantine texts, which briefly mention that the island was practically abandoned (Herrin 1972; Vroom 2003) and that its soils were very poor in the 10th century AD (Hetherington 2001: 174). Hetherington explains this general abandonment - and possible population retreat into the fortified citadel (cf. Lìpari, see below) - as being the result of the 8th century Arab conquest of Crete, which was used as a base to launch raids on the surrounding islands (2001: xvi). Following this, there is some pottery from coastal and inland sites dated to the Middle Byzantine period (11th-12th centuries), when Hetherington says the island was used 'mainly as a base for other operations' (2001: 174) (though it is unclear for what). The dearth of material found for the Early and Middle Venetian periods (or Late Byzantine, i.e. 13th-14th and 15th-16th centuries) suggests low population numbers, which only picked up in the Late Venetian (17th-18th centuries) and recent (19th-20th centuries) periods (Vroom 2003, in http://www.ucl.ac.uk/kip/byzmodceramics.php).

NAXOS

Naxos is the largest (428 sq km) and highest of the Cyclades (1000 m a.s.l.) (Fig. 7.3). Situated at the centre of the archipelago, the island has major valley systems with abundant arable land and springs (Broodbank 2000: 77). These characteristics make it one of the few Cycladic islands that could support a demographically self-sufficient population (Broodbank 2000: 88; see also Table 7.1). Human occupation here is documented from ca. 5200 cal. BC (Broodbank 2000: 125). At the beginning of the 1980s, the Neolithic finds from Naxos were few, amounting to a figurine from Sangri, bone *spatulae* from Zas, and 'reports of pre-Bronze Age material' at Grotta: according to Broodbank these were 'all promising signs, but insufficient to affirm colonisation by Cherry's criteria' (2000: 125). Twenty years of archaeological investigation have resulted in the identification of two Saliagos (LN) culture settlements at Grotta (Hadjianastasiou 1988) and Zas (Zachos 1990, 1996, 1999), three lithic sites, and two other scatters of Neolithic material (Broodbank 2000: 122, 125; Davis 2001: 59). The evidence from both Grotta and Zas shows that the sites were occupied during different periods, and the Zas cave especially provides one of the few almost complete stratigraphic sequences from the Cyclades (Zachos 1990, 1996, 1999): the basal layer (which contained Saliagos culture material) was covered by two FN layers (contemporary with Kephala and Grotta-Pelos cultures), and then by an EB I and a late EBII layer, the latter two separated by a stratigraphic gap.

During the Grotta-Pelos (3500-2700 BC) and EBII (2700-2200 BC) periods, several small settlements were dispersed throughout the island (Broodbank 2000: 177). These sites were probably occupied by just a few families or a couple of dozen people (*ibid.*). There appears to have been a steady increase in both number and size of sites in EB II (Broodbank 2000: 178). The island had three large settlements (Grotta, Mikri Vigla, and Rizokastellia) in the 2nd millennium cal. BC, when reduction in population is documented on other Cycladic Islands (see discussion on '2200-1900' gap). However, in the LBA most of the population clustered at Grotta, while at the other sites there is no evidence for occupation until the Iron Age (9th c. BC) (Hadjianastasiou 1989, 1993; Barber and Hadjanastasiou 1989) (cf. Kythera), when we know that the island was inhabited (Hetherington 2001). The only site where there is possible evidence of settlement continuity during this period is Grotta (Snodgrass 1971: 63). According to Snodgrass, Mycenaean-type communities found refuge here for a century following the 'great wave of disasters' and provided the nucleus for reviving Greek culture. Although Snodgrass claims that the settlement at Grotta survived throughout the Mycenaean IIIC, Protogeometric, and Geometric periods (1971: 361-5), Lemos has since argued that the area had become a burial ground and that the settlement must have been located elsewhere, possibly on the acropolis (Lemos 2002: 147). She concludes that Naxos was probably continuously occupied from the Bronze to the Iron Age, although there was perhaps a 'short gap' before the Early Protogeometric period (2002: 208). This possibility relies on a stratigraphic discontinuity at Grotta which was first noted by Condoleon (1949), the original excavator of this site. As noted by Desborough, Condoleon's original site report is not sufficiently detailed to either prove or disprove the existence of this gap, which is largely based on the different orientations of the foundation structures belonging to the LHIIIC and Protogeometric periods (Desborough 1964: 150). However, on the whole, Desborough (1964: 152) believed that the evidence from Naxos showed no interruption of habitation at the end of LHIIIC, but rather settlement dislocation (cf. Lemos 2002). Occupation on the island was then continuous from the Protogeometric period to the present day. Rome conquered Naxos in 41 BC and held it until AD 326, and subsequently the island became part of the Byzantine Empire (AD 362 - 1204) (Hetherington 2001: xix). In 1204, Venice took it over from Genoa and created the Duchy of Naxos, a dukedom which had control over most of the Cycladic islands (*ibid.*). Overall, the data from Naxos indicate that the island experienced drastic settlement contraction at the end of the 2^{nd} mill. cal. BC, when a single known site, Grotta, seems to have survived a phase of generalised abandonment.

MELOS

Melos is a medium-large island by Cycladic standards, with an area of 151 sq km and a maximum altitude of 750 a.s.l., it has extensive arable land (one-fifth of the total area, ca. 3000 ha) (Renfrew 1982b: 279) (Fig. 7.4). Heading east from the southern Peloponnese, the island, with its large bay, is the first Cycladic landfall when crossing the Aegean (Wagstaff and Cherry 1982: 258). The island is volcanic and supplies of ground-water are limited, with wells in the few areas of lowland alluvium (e.g. at Phylakopi and in the Chora plain) (Wagstaff and Gamble 1982: 98). The precipitation regime alternates a prolonged summer drought with a winter precipitation maximum of 450 mm, with the possibility of a whole drought year occurring two or three times a century (Wagstaff and Gamble 1982: 101). In spite of this, the fertile volcanic soils and skilful human use of the land ensure high agricultural productivity, which is evident in the present (Davidson and Tasker 1982: 82; Wagstaff and Augustson 1982: 132; Wagstaff and Gamble 1982: 98). Other resources ensured that people could live off the products of the island: apart from migratory birds and sea resources, hares and rabbits are known to have inhabited the island from at least the Late Bronze Age (Wagstaff and Gamble 1982: 98). Trees (oak and Aleppo pine) were probably initially used for building boats, but this activity may have stopped because of the increased pressure on reclaiming land for farming from forests (*ibid.*). Apart from these resources, the island supplies the only high quality obsidian in the Aegean (Cherry and Torrence 1982: 24). The fact that this obsidian has been found on the Greek mainland (at Franchthi cave) is evidence that people were going on boats to Melos already in the Upper Palaeolithic (Perlès 1987: 142). Using population estimates and grain yields adopted by Robb and Van Hove (2003: 246) and Broodbank (2000: 86), it emerges that the island could have produced enough grain to support up to 15,000 people, although at the highest estimated population density for the early prehistoric period (the EBII) this figure would have just exceeded 450 people (Broodbank 2000: 90).

As mentioned, the earliest evidence that humans went to the island is the Melian obsidian found at Franchthi cave on the Greek mainland dating to the Upper Palaeolithic (ca. 11,000 cal. BC) (Perlès 1987). Human occupation of the island intensified in the Late Neolithic, when Cherry and Torrence (1982) estimate between two and three dozen sites on the island (which they link to the exploitation of the obsidian sources rather than to settlement). Broodbank took this much later horizon to indicate that settlement had little if anything to do with the early phase of obsidian exploitation (2000: 128, 157). Occupation was continuous with one exception after this initial colonisation up to the Late Roman period, a fact that can be explained by some of the factors already mentioned (resources, soil fertility) (see Table 7.2 for detailed chronology). While the island was occupied during the much debated 2200-1900 cal BC period (the so-called

'Cycladic gap'), there is - in spite of intensive survey - a conspicuous lack of finds for the period from ca. 1100 to 800 BC (Sparkes 1982: 45), which finds parallels on Kythera and Naxos (with the exception of Grotta).

The island's abandonment was not sudden, and the process can be reconstructed by looking at the development of settlement on the island. Phylakopi, on the north-eastern coast of Melos, emerged as the island's single dominant centre during the 2nd millennium cal. BC, indicating that the many settlements known during the Neolithic and EBA had gradually extinguished by then (Wagstaff and Cherry 1982: 251). Phylakopi may have been the only site on the island to be permanently inhabited throughout the 2nd millennium (*ibid.*) (although another potential IIIB/C site is Agios Spyridou), when it was eventually abandoned ca. 1100 cal. BC (Sparkes 1982: 45). A second 'primate' settlement was founded in late Geometric times near the Bay, ca. 8 km away from Phylakopi, by a new group of inhabitants who settled what later became the classical site of Ancient Melos (Renfrew 1982a: 35 ff). Ancient Melos was occupied continuously throughout the Classical, Hellenistic, and Roman periods, before it was abandoned around the 6th century AD (Wagstaff and Cherry 1982: 251).

Occupation resumed in the 8th c. AD, when great demographic expansion is documented (Sparkes 1982: 47). This apparent fall and rise in population raises one again the question of 'archaeological visibility'. It has been suggested that once Ancient Melos was abandoned it was succeeded by a few scattered sites that were much smaller, and thus much less archaeologically visible, even if their location may still be indicated by the remains of a few early churches (Wagstaff and Cherry 1982: 254). The island may have been abandoned again between the late 9th and 11th-12th centuries, perhaps because of Arab raids during the late 8th-9th centuries, and was partly resettled at the end of the 11th century (ca. 1080) by small monastic communities, with population at the end of the 12th century being estimated as consisting only of a few hundred individuals (Sanders 1996: 148). In spite of this, according to Wagstaff, the island may have prospered under the Byzantine empire, to which it belonged until 1204 (Wagstaff 1982: 58). After the Fourth Crusade, Melos became part of the Duchy of Naxos (Hetherington 2001: 204). Chora emerged as the dominant centre by the late

17th century AD, but was replaced by the site of Kastro before the 19th century (*ibid.*).

KEA

Kea (130 sq km) is separated from mainland Greece by a narrow channel 12 km-wide. The stepping-stone island of Makronisos makes the crossing even more straightforward (Cherry *et al.* 1991b: 57). Kea, which is hilly and has good water sources, has steep coasts but also several small inlets and a large bay in the north-west (*ibid.*) (Fig. 7.5). The north-west of the island was the area targeted by the Kea survey (Cherry *et al.* 1991), which defined various phases of human occupation and abandonment for the island (Table 7.3). The earliest evidence for occupation in the survey area (and in Makronisos) dates to the Final Neolithic, when three sites are known: Kephala, Paoura, and Ayia Irini Period I (4th mill. cal. BC) (Cherry *et al.* 1991c: 225). The Neolithic material found on the island is very similar to that on the mainland, particularly Attica (to which, as mentioned, Kea lies very close) (*ibid.*).

Kephala, which has yielded evidence of a mixed farming economy, has been interpreted as a permanent settlement (based on its size, 2-3 ha, the density of material found there, and on an associated cemetery which was used over two or three centuries) (Cherry *et al.* 1991c: 225); Paoura, which so far lacks a cemetery, was larger and supported a community estimated at between 75 and 130 persons (*ibid.*). Coleman (1977: 111) suggests that Ayia Irini (Period 1) was settled once Kephala was abandoned. To the three main sites, Cherry *et al.* added the sites of Sykamia and two 'special-purpose' lithic scatters close to Kephala (1991c: 225-6). All of the Late Neolithic sites (except Ayia Irini) were short-lived and were abandoned before the start of the Early Bronze Age, and even Ayia Irini Period II may have been a new foundation (since there is stratigraphic gap after Period 1). The idea of a gap after Period I is supported by Davis (2001: 27), who notes that Period II is a 'fully developed EBII phase of occupation'. By the Early Bronze Age, Cherry *et al.* refer to Ayia Irini as 'a significant settlement integrated into regional exchange networks' (1991c: 226).

After prospering in Period II and III (2700-2200 BC) Ayia Irini was abandoned once more in EB III (there is another gap in the sequence of the site), only to be reoccupied in the Middle Cycladic period or early Middle Bronze Age (Ayia Irini Period IV, ca. 1900 BC), when nowhere else on the island seems to have been inhabited (Wilson and Eliot 1984: 78; Cherry *et al.* 1991c: 230; Davis 2001: 29). This period has been interpreted by some as a phase of generalised abandonment and decline in the Cyclades, although - as we shall see - this view has recently been challenged (Rutter 1983, 1984; Manning 1997; Broodbank 2000). Ayia Irini Period IV saw the building of fortifications, which were destroyed and rebuilt at the start of Period V (corresponding to the MMIIB/MMIIIA period). There is some material for the latest phases of the Bronze Age at Ayia Irini (Periods VI, VII, and VIII), but the rest of the island seems to have been abandoned (*ibid.*). Occupation seems to have gradually resumed in the Protogeometric and Geometric periods (mid-11th-8th c. BC), although it is possible that most of Kea was still abandoned, since high densities of pottery are dated only between 700 to c. 200 BC (Archaic to Hellenistic Periods), when four Archaic poleis were founded (Cherry *et al.* 1991e: 474-5).

From then on, occupation was continuous for some time (Sutton 1991: 245), although the island's main Roman centres produced little material after the 7th c. AD, when there is very little material from the survey area overall (Cherry *et al.* 1991d: 352). In fact there is hardly any material from north-west Kea that can be securely dated to the thousand or so years between the 8th and 19th centuries (1991d: 353), although ceramics do become more recognisable during the Middle Byzantine period (11th to c. early 13th c. AD) (1991d: 354). Only 15 sherds from nine locations have been identified as belonging to the period from the later 13th to mid 16th c.; finds of the Turkish period (16th to early 19th c.) are also missing, and artefacts either increase or become more easily recognised after the Greek revolution (*ibid.*).

CYPRUS

Cyprus, the third largest island in the Mediterranean (after Sicily and Sardinia), with a surface of 9,240 sq km and a 648-km long coastline, lies 97 km west of Syria and 64 km west of Turkey (Fig. 7.6). The main topographic features are a central plain ('Mesaoria'), surrounded by mountains both to the north (Kyrenia mountains) and to the south (Troodos Mountains) (max. alt. 1951 m a.s.l.), and several other plains scattered along the south coast. Cyprus enjoys a typically Mediterranean climate (hot, dry summers and cool, wet winters), and suffers moderate earthquake activity. The island has several resources, including small amounts of copper, pyrite, gypsum, timber, salt, and marble. Most fresh water sources are clustered in the north (http://kypros.org).

In spite of these favourable biogeographic characteristics, two potential occupational gaps have emerged in Cyprus. Early Cypriot chronology has been divided into the following phases (from Peltenburg 2003: 86, Table 11.2):

1. Akrotiri-*Aetokremnos* 10th millennium cal. BC-?
2. Pre-Khirokitia 9th- 8th millennia cal. BC
3. Khirokitia: 7th - 6th millennia cal. BC
4. Sotira 5th- 4th millennia cal. BC

Much debate surrounds issues of occupational continuity at the end of the first and third phases, while, as already mentioned in Chapter 4, the discovery of early pre-Khirokitian sites (Mylouthkia, Shillourokambos, and Kalavasos-*Tenta*), and the re-evaluation of the early pre-Khirokitian Tenta "Top of Site" dates (Todd 1987) in the light of these discoveries, have eliminated the 'awkward' 1,500 year gap between phases 2 and 3 (Peltenburg 2003: 85-86, 98). While it is possible that further research on Cyprus will also result in dismissing the other two occupational gaps, these still remain for the present (Peltenburg 2003: 94) and are thus investigated further in the next two sections. The later history of Cyprus is not dealt with in this study, as the island's subsequent occupation record was continuous.

The Akrotiri - pre-Khirokitia 'gap'

There appears to be a millennium-long gap between the occupation of Akrotiri-*Aetokremnos* and Mylouthkia Period 1 (Peltenburg 2003: 93). Binford has challenged the anthropogenic origin of the bone assemblage at Akrotiri-*Aetokremnos*, but has accepted that the site provides evidence of a much earlier human presence on the island than previously thought (2000: 771, see Chapter 4). The anthropogenic character of the bone assemblage found at the site is strongly supported by its excavator, Simmons (1999), who argues, with several others, including Peltenburg (2003), that the site demonstrates that hunter-gatherers lived on the island for some time. Peltenburg has pointed out that this possibility is supported by the fact that crossing the Klidhes Strait would have been made relatively easier at times of lower sea levels, because of stepping-stone islets in between (2003: 97). He also suggests that hunter-gatherers had not just the means but also the motives for making the crossing: changing sea levels may have caused loss of territory and resources on the mainland, which in turn may have prompted the colonisation of new territories and a move away from the mainland, in order to avoid extra competition over resources and overcrowding inland (*ibid.*).

Akrotiri-*Aetokremnos* should thus be considered as 'genuine' proof that humans were on the island (on the basis of the dated sequence of cultural features) (Simmons 1999). Therefore, we should ask perhaps not so much why the hunter-gatherer inhabitants left the area (this would probably be part of their resource exploitation strategy) but rather 1. how long they stayed; 2. whether they moved to other parts of the island; and 3. why they left the island altogether (if indeed they did).

As we have seen (Chapter 6), populations below 300-500 people cannot exist as closed communities (Adams and Kasakoff 1976; Williamson and Sabath 1984; Wobst 1974). Although several camps should have existed on the island to reach these numbers, the Akrotiri rockshelter is the only one known for this period (Peltenburg 2003: 95). It is possible, as suggested by Simmons (1999: 323; *contra* Binford 2000), that once the island's megafauna was killed, other resources were used (e.g. birds and shellfish) until the island was abandoned; however, Peltenburg *et al.* argue that resource exhaustion would not be an obstacle, since visits to the mainland were possible (and indeed vice versa) and animals could be re-introduced to the island (2001: 46). The possibility of movement also means that the existence of several contemporary camps was not strictly necessary.

The fact that Akrotiri is a 'one-off' makes it impossible to conclude whether a population survived in Cyprus after the site was abandoned (i.e. a transition as opposed to a gap), or whether its inhabitants lived more regularly on the island or on the mainland (Simmons 1999). Seasonality patterns from the site however do indicate that the shelter was probably occupied all year round (Simmons 1999: 181). The currently accepted scenario is that the island was abandoned and subsequently recolonised by farmers from the mainland: this is in view of the lack of any further evidence from this period and of the strong similarities between Cypro-PPNB and Syro-Anatolian traits in the following millennium (Vigne *et al.* 2000; Peltenburg *et al.* 2003: 96; see Chapter 4).

The Khirokitia-Sotira 'gap'

Another occupational gap sits rather conspicuously between the end of the Khirokitia aceramic Neolithic and the start of the ceramic Neolithic, or Sotira period. The gap is again in the order of a thousand years (even if, as noted by Cherry [1990], the latest Khirokitia and earliest possible Sotira dates are considered). In strong contrast to the situation for the earlier Neolithic, the state of affairs has not changed greatly since the early 1990s, when Cherry made the point that 'to envisage uninterrupted expansion... after the Khirokitia Culture, despite the absence of sites, presupposes a massive inability to recognize relevant evidence' (1990: 157). There is no later aceramic Neolithic evidence at Mylouthkia, and Peltenburg *et al.* have made the suggestion that occupants left the site and moved inland to Kissonerga, which - they note - is however almost a thousand years later (2003: 93). This chronological gap prompts the question as to what happened in between.

Held (1989b: 171-208) originally explained the absence of sites in terms of a form of involution and decrease in settlement, rather than actual abandonment. Cherry, on the other hand, pointed out that the disappearance of so many long-lived sites pointed towards an 'extinction model' (1990: 157). The longevity of the Khirokitia phase is striking (it lasted up to two millennia according to Held [1989b: 211-284] and Knapp [1990: table 1]), with more than 20 sites known in 1990 (Cherry 1990: 155), possibly even exceeding 50 - although only 17 or 18 are considered as being actual settlements (Held 1986: 10).

While total abandonment remains a possibility, it is hard to see what triggered such a wholesale depopulation of the island at this stage. It seems reasonable to support Held's view (1989b) and argue in favour of changes in settlement patterns, as discussed by Broodbank (2000) for the Neolithic Cyclades, with a pattern of larger settlements replaced by a more dispersed set of much smaller and less archaeologically visible sites. Site visibility issues are also mentioned by Peltenburg and Bolger in their preliminary reports of the Western Cyprus survey, particularly for the 4th-3rd millennium transition (or Late Sotira-Chalcolithic). They argue that there was Late Neolithic/Sotira occupation, but that it is underrepresented on the ground. They argue, on the contrary, that the rapid decrease in the number of Late Chalcolithic settlement in the later 3rd millennium BC (cf. Cyclades) can be seen as a real pattern of abandonment (http://www.arcl.ed.ac.uk/arch/lemba/LARC_wcs.html).

PALAGRUŽA

Palagruža is a tiny island (0.3 sq km) in the middle of the Adriatic (130 km from the nearest mainland) (Fig. 7.7). The main topographical features are a promontory (90 m a.s.l.) at the western end of the island and a ridge to the east broken by two small plateaux (Kaiser and Forenbaher 1999: 321). Because of its limited size and relief, the island has little arable land, although in medieval times ca. 7 ha (=0.07 sq km) were terraced and grain was grown (*ibid.*). Palagruža has no source of fresh water, but rainfall throughout the year is enough to support some vegetation and small-scale dry farming (Kaiser and Forenbaher 1999: 313). Table 7.1 indicates that the island could not sustain an endogamous population at prehistoric densities discussed in Chapter 6.

In spite of this limited biogeographic potential, the island has revealed six archaeological sites, dated to the Early Neolithic (6^{th} mill. cal. BC), Late Copper/Early Bronze Age (Cetina culture, c. 2500-1800 cal. BC), Classical and Hellenistic Greek, and Roman times (Kaiser and Forenbaher 1999: 314). While it is likely that people still went to the island (or stopped over) after the Early Neolithic, there are no traces of regular human presence in the Middle and Late Neolithic (5^{th}-4^{th} mill. cal. BC) (1999: 321), and according to Johnston there is no evidence of occupation after the Early Bronze Age until the 6^{th} c. BC (Johnston 2002: 28).

As mentioned, the lack of biogeographical resources is in stark contrast with the rich archaeological record of the island, although in the context of this discussion, it may account for its discontinuity. A chert source on neighbouring Mala Palagruža (an islet just 200m away) may have provided the motive for initial visits to both islands (since they lie in such close proximity), and their role as stop-overs, positioned in the heart of the Adriatic, is another obvious reason. There is evidence that chert was widely processed: on Palagruža there is an extensive surface scatter of worked chert debris (over an area of more than 6,000 sq m) (Kaiser and Forenbaher 1999: 319). The repertoire is restricted (mainly blade segments and arrowheads), and not typically domestic, which Kaiser and Forenbaher took to indicate craft specialism, intended for exchange rather than for local consumption (*ibid.*), and that the occupants of Palagruža were 'part-time residents' (1999: 321). Evidence for exchange comes from finds of (possible) Palagruža chert on the Dalmatian islands of Hvar and Vis, and bladelets of Lìpari obsidian found on Palagruža (*ibid.*).

Kaiser and Forenbaher believe that people began to stay longer on Palagruža from the end of the Copper Age/Early Bronze Age, which is when deep-sea fishing is believed to have started in the area (Kaiser and Forenbaher 1999: 321). This is supported by Chapman *et al.* (1996: 283-6), who place the first permanent occupation of Palagruža in the Cetina period, which on the mainland is characterised by cairn burials, some of which have produced chert products from Palagruža, indicating that the island was part of the Cetina cultural network (Kaiser and Forenbaher 1999: 322). When the mainland elites began to use bronze, it is likely that interest in Palagruža's chert declined rapidly, but the island was still visited as a convenient stop-over (1999: 323), which has remained the main role of the island up to the present day. There are just a few sherds to indicate a Greek presence on the island from the Archaic until the Hellenistic period (Johnston 2002: 28). Johnston suggests that during the earliest period, dedications to Diomedes (who is linked with maritime trade and travel) on the sherds indicate that the island was used occasionally by mariners for ritual purposes (the sailing season is from April to October); while between the 3rd and 1st c. BC, Palagruža's position caused its involvement in conflicts between the Romans and Illyrian pirates, and then its take-over by the Romans (*ibid.*).

HVAR

Hvar has a surface of 312 sq km and a maximum altitude of 626 m a.s.l., and lies, with its smaller satellite islets, very close to the Croatian mainland (ca. 2 km) (Figs. 7.8-7.9). The island has good arable land and benefits from a rainfall regime of ca. 800 mm/year evenly spread throughout the year.

The island has been the subject of extensive archaeological survey (Adriatic Islands Project, AIP), which has resulted in the definition of a series of phases of occupation (Gaffney *et al.* 2000: 186-7). The evidence for the earliest occupation of the island is Early Neolithic impressed ware found in a cave site (Markova Špilja). Occupation continued in the Middle Neolithic (ca. 6750-6500 cal. BC) (Danilo culture) and into the Late Neolithic, when the main culture for this period in Croatia is named after the island itself, Hvar culture (Novak 1955).

The island's settlement record as a whole can be contrasted with the history of individual sites. Excavations at the Grapčeva cave (Novak 1955; Gaffney *et al.* 2000) have produced evidence of 3500 years of occasional occupation, spanning the periods from the Late Neolithic to the Bronze Age. Material evidence shows that people visited the cave repeatedly during the 5th millennium cal. BC (Late Neolithic), and that occupation continued during the Late Copper/Early Bronze Age. The first archaeological discontinuity in the island's record occurs in the Middle Bronze Age (cf. Palagruža), with very little evidence for settlement and land use in the AIP survey area. The same period is also poorly known on the mainland (central Dalmatia) (Gaffney *et al.* 2000: 187). Gaffney *et al.* mention that this decrease in evidence could be interpreted as a real pattern of depopulation, although MBA pottery was recently found associated with a large enclosure above the town of Hvar (*ibid.*), suggesting perhaps a change from a more dispersed to a more nucleated settlement pattern on the island at this stage.

Settlement increased again both on the mainland and on Hvar during the Late Bronze Age and throughout the Iron Age (ca. 11th-10th c. BC), both in defended hilltop enclosures and in non-defended locations (e.g. Stari Grad) (Gaffney *et al.* 2000: 188). There are signs of increased exchange between the Dalmatian and Apulian coasts during this period (finds of Liburnian manufacture in Italy, and Apulian Geometric pottery in Dalmatia) (*ibid.*).

When the Greeks reached Hvar, they probably first settled at Pharos, at Stari Grad, which was founded in 385-4 BC (Gaffney *et al.* 2000: 192). The colony and its agricultural hinterland supported a population of ca. 1100 people, and it is estimated that, in the 4th-3rd c. BC, up to 1000 people lived in the town itself, before the colony was destroyed in 219 BC and suffered a long decline during the Hellenistic period (second Illyrian war) (Gaffney *et al.* 2000: 193). Following this, Pharos became a Roman possession (it was a colony by the late 1st c. BC), from which point on several rural settlements prospered on the island, both in the Stari Grad plain and elsewhere if fertile land was available (Gaffney *et al.* 2000: 194). Wilkes has linked this period of prosperity to immigration from the Italian penisula (1969: 230-5). The location of the main Roman sites seems to respect those of pre-Roman Illyrian communities, but, according to Gaffney *et al.* (2000: 195), the introduction of water-resistant concrete for building water cisterns allowed new foundations in arid areas, such as the southern coast of the island, which was settled at this time, but not again until the 15th c. AD.

Most Roman villa sites were abandoned in the 3rd c. AD, when substantial land clearance suggests that the island became a single estate centred on a single villa (as on the nearby island of Šcedro), controlled by Salona, the main colony on the Dalmatian coast, up to the 5th-6th c. AD (Gaffney *et al.* 2000: 196). The 6th c. AD on Hvar saw a period of massive fortification building, such as that at Gradina, which protected the small peninsula near Jelsa. Hvar suffered the consequences of the fall of Salona in the 7th c. AD, which cut off the island communities that had relied on the capital. Only one villa (Carevac), located in the middle of the plain, may have lasted into the 6th and 7th c., but other large villa sites disappeared one or two centuries earlier (Gaffney *et al.* 2000: 197).

PITIUSSAE ISLANDS

The two Pitiussae islands lie very close to each other (less than 1 km), and are ca. 90 km away from the Spanish mainland and ca. 50 km from the Balearics (Fig. 7.10). They also have very different geological and topographical characteristics: Ibiza, the larger of the two (572 sq km, with a coastal development which is 142 km long and a max. alt. of 475 m a.s.l.), benefits from small fertile plains overlying clay layers, which hold a considerable water table that emerges in places (Bellard 1995: 442). Bellard points out that, though irregular, the annual rainfall (400 mm/year) is sufficient to support farming on the island, which otherwise lacks other resources: it has very few large mammals (only the rabbit and the genet survive and there is no evidence that *Myotragus balearicus* ever inhabited the island) but lots of birds. Formentera (82 sq km and a coast which is 65.5 km long) is flatter (max. altitude is ca. 200 m a.s.l.). The current annual precipitation (370 mm) is slightly lower than Ibiza's, but its different geology (which is mainly calcareous) does not retain water, and the island has very little vegetation (*ibid.*).

Bellard (1995: 448-449) has argued that human presence on both these islands, which as discussed (see Chapter 4) began around 2000 cal. BC (Bellard 1995: 447; Costa and Guerrero 2002: 489), does not seem to continue after 1300-1200 cal. BC (EBA-MBA), when the rapid disappearance of open-air habitation sites, caves, and megalithic tombs indicates that the islands may have lacked a permanent population. This evidence (or lack thereof) prompted Bellard to conclude that Formentera was uninhabited until the fourth century BC, and Ibiza until 650 BC, when they were settled by the Phoenicians/Carthaginians (Bellard 1995: 451, 453; Gonzàlez and Díes 1992: 348-53).

Costa and Guerrero point out that the latest available evidence from the EBA-MBA periods on Ibiza comes from sites excavated before the mid 1980s (which are largely unpublished), such as Puig de ses Torretes, Cueva Xives, and Cueva des Culleram (2002: 491-2). In Formentera, this period is better documented (Ca na Costa and another 21 sites on Cap de Barbaria, Can Marroig, Punta Prima, etc.) (*ibid.*). They argue that renewed attention to these sites may begin to disprove or at least reduce the occupational gap on the two islands (2002: 495). Their revision relies on two sets of evidence: the burials from Can Sargent (Sant Josep, Ibiza) and a set of hoards of metal objects.

Can Sargent was originally interpreted as a megalithic burial ground, but according to Costa and Guerrero (2002) it is best seen as an enclosed dwelling. They believe that only subsequently was the site used as a burial ground (on either side of the enclosure) by a small community. An external burial was dated to 720 BC, while an inside one to 550 BC, making it hard to see how Costa and Guerrero (2002) can relate these to the structure's earlier phase of use. Bellard (1995) gives a different interpretation of Can Sargent: the corridor and part of the chamber, Can Sargent I, which he interprets as a megalithic tomb, produced little material, but a small dagger of Argaric tradition was dated to 1700-1300 cal. BC (Topp *et al.* 1979, Fernàndez and Topp 1984). According to Bellard, the later dates obtained from the human bones indicate that the tomb was later re-utilised or that the sample was contaminated (1995: 446). On the basis of this evidence, Can Sargent cannot be taken to represent continuous occupation.

Several hoards of axes and bronze ingots found scattered in six different areas of the islands were described by Delibes and Fernández Miranda as possibly belonging to the time falling in this chronological gap (Delibes and Fernández Miranda 1988: 84-01). Bellard, however, notes that most objects in these groups are dated to 8^{th}-6^{th} centuries BC (and therefore probably related to a Phoenician passing presence), and that only a few objects are older (prior to 1200 cal. BC). Costa and Fernández (1992: 325-6) have argued that the hoards are atypical of the Phoenicians, and suggest that an indigenous population was present on the island before the Phoenician settled permanently around 650 BC. This point is dismissed by Bellard (1995: 450), because there are no other signs, apart from the hoards themselves, of this presence. Instead Bellard (1995: 451) argues that abandonment is the likely scenario, and that this may have been caused by limited food resources and adverse climatic and environmental conditions.

While the two islands are faunally impoverished, they are not very different from the Balearics or the Spanish mainland from the point of view of their climate and vegetation, and Bellard's (1995) argument may not therefore be sufficient to explain the abandonment of the Pitiussae (he used the same argument to explain their late colonisation). Bellard, however, also looked at what cultural processes were taking place nearby, and noted that the Pitiussae gap coincides with the beginning of the Talayotic period on the Balearics. Lewthwaite believes that this was a development from the previous Pretalayotic culture (1985b: 220), while Plantalamor argued that it represented the arrival of new immigrants (from either Malta or Sardinia) (1991, 1992: 122). Bellard (1995: 452) explains that both explanations present problems: if Lewthwaite is right, it is unclear why the Talayotic culture did not develop on the Pitiussae islands; while if Plantalamor is correct, it is hard to see why the immigrants did not settle in the Pitiussae. More recently, Lull *et al.* (2002: 122-3) have commented on the fact that material evidence from a number of sites on the Balearic Islands indicate important changes ca. 1200 cal. BC, particularly in the so-called 'naviform' settlements, which became larger and accommodated more complex structures. The sites of Cova des Carritx and Cova des Mussol on Menorca indicate contacts between the Balearic Islands and parts of central Europe, North Africa, south-west Spain, and possibly Sardinia, which increasingly intensified during the Prototalayotic (roughly equivalent to the Pretalayotic) period (1050-850 cal. BC). Lull *et al.* suggest that the islands were part of a broad exchange network of goods, technology, and ideology, a fact that, together with the lack of evidence for violent occupation, discounts the need for demographic immigration to explain cultural changes on the Balearic

Islands at this time, while remarking that the development of Ibiza and Formentera during this period remains 'an open question' (Lull *et al.* 2002: 124).

Despite a surface of some size and their position in sight of the mainland, it does seem that settlement on the Pitiussae Islands was both late and intermittent. Food and water resources were important factors in deciding where to settle, particularly if some choice was available (Mallorca, being rich in water and mammals, may have been favoured). Ibiza also has water sources, which were no doubt valued and used; however, it is possible that the general lack of other resources ultimately led to its abandonment (equally for Formentera). This may seem contradictory in the light of the likelihood of island networks of mutual assistance and movement of goods, which were aimed at ensuring the livelihood of islands with fewer resources (although distances between the Balearic and the Pitiussae Islands are greater than those between most Cycladic or Aeolian Islands). However, the very existence of alternatives, combined with the fact that population numbers would have been low, means that the settlement of environmentally marginal lands (such as the two Pitiussae) was not necessary (cf. the 'pull' or 'mainland' factor, see Chapter 6).

Similar processes of occupation, expansion, and contraction within an archipelago are paralleled on the Aeolian islands, and will be explored further in the next section. But before doing so, it is worth remembering that other more contingent factors may also have contributed to settlement contraction, and that these may be harder to identify in the archaeological record. The recent past illustrates this possibility: Formentera was abandoned between the 14th and 17th centuries AD because of raids by Berber pirates (Marí Cardona 1983: 9, Gordillo 1981: 213-15); and the plague in 1348 hit the islands, devastating the population of Ibiza (Vallès 1993: 60-1).

AEOLIAN ISLANDS

The seven Aeolian islands lie north of Sicily, between 20 and 40 km from the coast and between 55 and 115 km from southern Italy. They are all volcanic (their average max. alt. is 700 m a.s.l.), and they range in size from Panarea (3.4 sq km) to Lìpari (37.6 sq km). Volcanic activity is most evident on Vulcano and Stròmboli (which is permanently in eruption). Table 7.1 indicates that none of the islands could support an endogamous population at low densities; however, the archipelago as a whole was potentially demographically self-sufficient.

The first colonisation of the Lìpari islands has already been discussed (Chapter 4 and Dawson 2000), by combining the work of Bernabò Brea and Cavalier with more up-to-date information from other sources. The amount of work carried out on the islands allows us to investigate abandonment processes at the level of the entire archipelago as well as that of the individual islands and sites. Lìpari, Salina, and Filicudi were the first islands to be occupied in the early Neolithic (Stentinello) (Lìpari slightly earlier). Lìpari continued to be occupied, while occupation on the other islands has been intermittent (Bernabò Brea 1957).

Two facts emerge from the review of occupational evidence from the islands: that the archipelago experienced both phases of settlement expansion and contraction, and that some island communities appear to have behaved in rough synchrony at certain temporal junctures. This also prompts reflection on whether we can ascribe communities to individual islands or whether we should envisage an 'Aeolian' population, since their behaviour would clearly be different depending on their allegiances and degree of self-sufficiency. Filicudi and Salina, amongst the first islands to be occupied together with Lìpari, were both abandoned in the Early and Late Copper Ages (it is disputable whether they were abandoned in the Middle Neolithic and re-occupied in the Late Neolithic – see below). They were reoccupied in the Early Bronze Age, and subsequently abandoned again in the Early Iron Age. Panarea and Stròmboli, to the east of Lìpari, which were occupied at times when Salina and Filicudi were uninhabited, also appear to behave in unison at this stage. Alicudi, the furthest island to the west, was occupied for a short period during the Early Bronze Age, which is the only time when the whole archipelago (apart from Vulcano, as far as is known) was occupied.

Phases of expansion and contraction are identified by combining evidence from all the islands (summarised in Balistreri *et al.*'s archaeological map [1997: 643], see also Chapter 4). This chronology is based on long phases which have been dated on the basis of pottery typologies, which are found over periods of 1000 or 500 years. The limited number of radiocarbon dates from the islands means that the actual occupation of the sites cannot be dated more accurately. However, it is rather striking that occupational gaps appear to have been the norm for all the islands, except Lìpari. Data from the island of Salina are reviewed in more detail in order to follow the development of individual settlements.

Expansion

Human occupation started off in Lìpari in the mid 6th millennium cal. BC and soon after on nearby Salina and Filicudi. Abandonment has been hypothesised for Salina and Filicudi to account for the lack of later Neolithic painted wares (Balistreri *et al.* 1997: 642). However, it is likely that the site of Rinicedda continued to be used up to the Diana period (Late Neolithic), since painted wares tend to be found in ritual contexts, such as caves, rather than domestic ones (Whitehouse pers. comm. 2004). In addition, while intuitively we can assume that the people on Filicudi would have to rely on Salina, the closest and largest island to its east, it is less obvious why the early Neolithic village of Rinicedda, with its good agricultural land, would have been abandoned and never reoccupied. Evidence for expansion at this time from nearby Lipari lends support to this interpretation: Stoddart noted that there was a shift in the mid-5th millennium cal. BC from a centralised pattern based on defensive sites (i.e. the Acropolis) to a more dispersed pattern of unfortified locations on plains (such as Contrada Diana and Piano Conte) and occasionally up-hill (Piazza Monfalcone) (1999a: 65). During this period (Diana culture), which is importantly also the period of maximum expansion of obsidian exploitation on the islands, other sites are found on the other islands, at Fossa delle Felci and Serro del Brigadiere on Salina, at Calcara on Panarea, and at Capo Graziano on Filicudi (Balistreri *et al.* 1997: 643).

By the end of the Diana phase, the villages on Salina and Filicudi were abandoned. Whereas Sicily, the Aeolian islands, and southern Italy behaved more or less in cultural unison during the Neolithic, Bernabò Brea

(1957: 61) argues that during the following Copper Age they began to show more marked regional differences. At the same time, the decline in the obsidian trade and the rise of metal traditions also caused changes in the sea routes used to move goods between east and west (particularly Sardinia, Spain, and France), with the Sicilian channel (between Sicily and Tunisia) and Malta now preferred to the Strait of Messina (Bernabò Brea 1957: 69, 1997: 415). This damaged the economy of the Lìpari islands, with the obsidian trade almost disappearing by the Middle Bronze Age (Bernabò Brea 1957: 48, 1966: 99, 1977; Bernabò Brea and Cavalier 1980a).

Contraction

Two distinct successive Copper Age stages have been identified in the Aeolian Islands: Piano Conte (named after the site in the uplands of Lìpari) and Piano Quartara (identified for the first time on Panarea). Overall, both are considered to be a period of demographic and economic decline (Bernabò Brea 1957: 21). In the first phase (3500-2600 BC), only the Piano Conte and the Acropolis sites on Lìpari continued to be occupied, and Strómboli was occupied for the first time (Serra Fareddu). During the second phase of the Copper Age (2600-2200 BC), the site of Piana Quartara on Panarea, already occupied in the Diana phase and then abandoned, was reoccupied, and another site was founded on the island, at Drauto, while a new site at Pianicelli was founded after the abandonment of Serra Fareddu on Strómboli. The site of Piano Conte on Lìpari was also abandoned, and only the Acropolis was occupied at this stage (Bernabò Brea and Cavalier 1968, 1980a; Balistreri *et al.* 1997).

Expansion

Contraction during the Copper Age was followed by a great deal of expansion and revival in the succeeding Early Bronze Age, when 15 villages are known throughout the islands. As mentioned, the obsidian industry had practically disappeared by the beginning of the Middle Bronze Age, and was gradually declining throughout the Early Bronze Age. The phase is named after the village of Capo Graziano on Filicudi (Bernabò Brea 1957: 104;

Bernabò Brea and Cavalier 1991) (Figs. 7.11-7.12). On this island, the areas of two previously occupied sites were resettled at this stage: in the area of Capo Graziano occupation resumed in the EBA after a break that may have lasted up to 1500 years, while Piano del Porto was reoccupied following a ca. 1000-year break. To the west of the archipelago, Alicudi was settled for the first and only time (the site of Fucile). On Salina, two unfortified new villages were founded at Malfa and Serro dei Cianfi. On Lìpari, three other unfortified villages were founded at Contrada Diana, Castellaro Vecchio, and Predio Megna. These areas were all reoccupied after being abandoned for roughly a millennium during the Copper Age, while a new site was founded at Pignatara. While settlement continued on the Acropolis, Piano Conte was abandoned and not subsequently reoccupied. On Panarea, there was a new foundation at Punta di Peppa Maria, and occupation resumed at Calcara, Piano Quartara, and Punta Milazzese. A new site was founded on Stròmboli at San Vincenzo, in the north-east of the island (Balistreri *et al.* 1997).

Bernabò Brea (1997: 415) linked the increase in settlement and the shift to coastal locations to the fact that the Strait of Messina became a major trade route again, but he also explained cultural differences between the islands' Capo Graziano pottery and the contemporary Castelluccio on Sicily and southern Italy by the arrival in the Aeolian islands of a new group of people (the 'Eoli') (Bernabò Brea 1957: 106, 1985, 1997). Population replacement is difficult to substantiate, but Malone *et al.* (1994: 186) and Giannitrapani (1997b: 433, 438) have also suggested that the islands' Early Bronze Age culture combined Aegean and Anatolian cultural elements with local Copper Age features. Bietti Sestieri (1997: 474) is also in favour of integration rather than of a new people replacing the indigenous population. In her view, Aegean travel to Sicily and the Lìpari islands increased at this time, resulting in the similarities noted in the archaeological record.

Contraction

Six villages are known from the islands during the Middle Bronze Age (Milazzese period). On the Lìpari acropolis, there is evidence for settlement continuity during this period, while a new site was founded in the south of the island at Urnezzo. The Milazzese village, which gives its name to the whole period, lay in a fortified promontory on Panarea, and had up to 50 huts and counted 200 people (Bernabò Brea and Cavalier 1968) (Figs. 7.13-7.14). Another naturally defended village was founded at Portella, Salina. Both Milazzese and Portella were destroyed (Bernabò Brea 1957; Bernabò Brea and Cavalier 1968: 144). The village of Capo Graziano in Filicudi was still in use during this period. There are no cemeteries on the islands for this period, but a substantial cemetery was excavated at Milazzo (in mainland Sicily), which displays strong links with the Italian mainland (Bernabò Brea 1957: 124; Bietti Sestieri 1997: 475, 481; Di Gennaro 1997: 427).

According to Bietti Sestieri (1996, 1997: 475) and Tusa (1992), the Milazzese inhabitants continued to have contacts with people from the Italian mainland during this period, although perhaps they also began to fear them, which is why fortified locations were selected. The islands were also in contact with the west via Ustica, which flourished during this time (Marazzi 1997: 371; Holloway and Lukesh 1995; D'Agata 1997: 447). During this period, Mycenaean contacts were highly intensified (Harding 1984; Vagnetti 1993). However, in spite of these increased contacts and prosperity, there was a marked reduction in the number of settlements occupied (from fifteen EBA villages to six MBA), a marked shift to defended locations, and eventually the destruction of Middle Bronze Age settlements on the Aeolian islands and the temporary abandonment of coastal sites in Sicily, which Bietti Sestieri (1988) has explained by the increased competition and tension introduced by contact with the outside world.

Bernabò Brea described this period as marking the beginning of a 'Dark Age', which ended only with the Greek colonisation of Sicily and southern Italy five centuries later (1957: 136). He argued that the islands' culture was wiped out by the arrival of new people, the so-called Ausonian groups, from Italy into Sicily in the Late Bronze Age (Bernabò Brea and Cavalier 1980a: 705ff.; Tusa 1992: 533ff; Leighton 1996: 100; Procelli 1996: 100; Bietti Sestieri 1997: 479; Nicoletti 1997: 527). Two phases can be distinguished in the Ausonian culture. Ausonian I pottery (which spans a period of two hundred years) has been found only on the Lìpari acropolis, while everywhere else villages of the Milazzese culture were destroyed. This Ausonian I site was also destroyed at the end of the 12th century BC (Bernabò Brea 1979; Bietti Sestieri 1997). Bietti Sestieri (1997: 485, 489-90) notes that there is no evidence to explain this destruction, but during Ausonian II (which lasted at least three centuries, ca. 1150 - 850 BC) links with the Aegean ceased and contacts with Sardinia became more frequent. Ausonian II material is found at Milazzo (Sicily), but not on any of the smaller Aeolian islands, which were most probably uninhabited at this time (*ibid.*).

Further contraction/final expansion

The processes reviewed so far appear to speed up dramatically during the last two thousand years, as the resolution offered by history allows us to define phases of cultural development on a much finer chronological scale than for prehistory. The archipelago's population was concentrated in the Lìpari acropolis for at least five hundred years, while the rest of the island was empty, until, as Stoddart points out, the island became involved with state-organised societies (1999b: 69). From then on, the islands witnessed phases of growth and involution, lasting centuries or sometimes just decades. However, Lìpari remained the focus of human occupation throughout the historical period, and it is only in recent decades that the islands have started to 'behave' more like an archipelago again.

Meligunís, also known as Lipàra, was founded by Greek colonists on Lìpari in 580 BC, partly to control the Etruscan expansion (La Rosa 1996: 153). Castagnino Berlinghieri points out that Lìpari may have been uninhabited from ca. 800 BC to this time, even though there is some evidence on the island of contact with the Greek world in the 7th c. BC (Cavalier 1985: 31; Castagnino Berlinghieri 2003: 79). Lìpari then became an ally of Syracuse in the Peloponnese war and was repeatedly attacked by the Athenians. During the first Punic war, Lìpari was allied to Carthage and completely destroyed by the Romans (252 BC), after which it suffered a long decline (Bernabò Brea and Cavalier 1998: 191-96). Medieval Lìpari (6th c. AD) was a fortified town which orbited around the Cathedral. Its inhabitants were deported by Arab pirates in the 8th c. AD. The Normans restored some prosperity and a group of Benedictine monks founded a monastery and an abbey in the town, but in 1544 Barbarossa burnt Lìpari down and deported all the inhabitants. The citadel was immediately reconstructed by order of the Spanish viceroy, who also ensured it was resettled. Finally, in 1783 a major earthquake claimed most of the population, but also prompted steady reconstruction (La Rosa 1996: 153).

Salina

This section explores the occupational history of the island of Salina, the second largest in the group (26.8 sq km, max. alt. 962 m a.s.l.). Salina is a fertile island and lies less than 5 km away from Lìpari. The site at Rinicedda, in the south-west of the island, was among the earliest to be occupied (early Neolithic Stentinello - 6th mill. cal. BC). The village, of which only one hut has been systematically excavated to date, was situated in the SW of the island, in full view of the site of Castellaro Vecchio on NE Lìpari, supporting a scenario of 'balanced cohabitation' (Castagnino Berlinghieri 2003: 50) (Fig. 7.15). In the following Diana (Late Neolithic) period, two new sites were occupied, Fossa delle Felci on top of the eastern peak, and Serro del Brigadiere on the south-east coast and, and it is possible that Rinicedda was still in use (*contra* Balistreri *et al.* 1997). The sites were abandoned during the Copper Age (3500-2500 BC). In the Early Bronze Age (c. 2500 BC), two new sites were founded in the island at Malfa and Serro dei Cianfi, along the northern coast. In the following MBA, overall occupation in the archipelago was reduced from 15 to 6 villages, of which two were on Salina: Serro dei Cianfi continued to be occupied and a new site emerged at Portella, in the north-east corner. Both were abandoned in the Early Iron Age.

MALTA

Malta is the largest island in the Maltese archipelago (which also includes Gozo and the islet of Comino). The island, which lies ca. 95 km south of Sicily (and ca. 280 km north of Tunisia), has a surface of 246 sq km, a 136-

km long coastline (nearby Gozo has a coastline of 43 km), and a maximum altitude of 253 m a.s.l. (Fig. 7.16). Malta is a rocky island with indented coastal cliffs, but also offers some good harbours. Arable land in the present occupies ca. 38% of the total surface, which is much higher than most Mediterranean islands of its size, and the island is one of the most densely inhabited regions in the world (2001 population: 394,583 inhabitants) (http://www.1uptravel.com/international/europe/malta/geography.html). The average annual rainfall is ca. 500 mm (Trump 2002: 19) and there are no permanent water sources on the archipelago, although there are seasonal springs and rock pools (Hunt and Schembri 1999: 41). Neolithic and Bronze age water cisterns are known at several locations (Hal Saflieni, Misqa, and Mnajdra) (Trump 2002: 19). Trump (1977: 607) pointed out that the islands currently suffer from near-drought every ten years and from extended drought every few centuries. In spite of this, he points out that the islands were 'well suited to human inhabitation' (Trump 2002: 19) and may have supported a prehistoric population of up to 10,000 people (Trump 2002: 21).

Maltese chronology is well understood; however, Stoddart points out that 'the degree of discontinuity, and potential for abandonment, between phases of political development is unclear' (1999a: 138). Population replacement is often invoked to account for stylistic differences between periods (e.g. between Red Skorba and Zebbug pottery) (Trump 2002: 31). While Anati (1988) argued that the Maltese islands went through several phases of abandonment in prehistory, Stoddart claims that these were rare (1999a: 138). In particular, he maintains that, since the islands are agriculturally self-sustainable, even in the event of a bad crop, out-migration would not be a necessity; thus, he argues that phases of discontinuity (such as the end of the temple phase) cannot be linked to ecological and economic decline (Stoddart 1999a: 138, 1999b: 69). Similarly, changes in material culture can be explained by increased/reduced contacts with the outside world (Trump 2002: 31) and the development of local styles (Robb 2001: 188).

The transition from the Tarxien Temple to the following Tarxien Cemetery phase has attracted great attention and a variety of explanations, ranging from natural events (Hughes-Clarke 2002) to the rise of internal factionalism (Dixon 1998). It has also sparked a lively debate concerning the nature of Maltese societies and their contact with the outside world during this period, in particular concerning ideas of physical vs. cultural insularity (Stoddart 1999a, 1999b; Robb 2001) (Fig. 7.17). Evans (1971b: 224) interpreted the end of the Temple phase as a collapse of the island's political organisation, and claimed that the only explanation for this change was population replacement. He stated that 'nothing in the later prehistoric material warrants the assumption that any of the original people survived. If they did they left no trace of themselves in the material remains of the new period' (Evans 1959: 168). Trump also argues against continuity, but alludes to the possibility that the Tarxien Cemetery phase represents a 'rejection of the preceding cultural expression', rather than actual population replacement (1980: 144). Stoddart (1999a, 1999b) claims that the Temple phase construction ceased as a result of ideological and political changes, rather than because of some catastrophic event or an invasion. Bonanno (1990) and Dixon think also along similar lines, i.e. that the change was the result of an 'internal reorganisation of the existing culture' (Dixon 1998: 38).

The evidence for discontinuity comes from the temples and cemeteries rather than from settlement remains, which are lacking in the island, making it difficult to argue for actual abandonment (Stoddart 1999a: 142). Only three habitation sites are known from the Temple period: two huts from Skorba, and a hut and a stone wall from two separate locations on Gozo (Trump 2002: 205); however, greater quantities of surface pottery on the island (compared to that from the previous Ggantija phase) can perhaps be taken to indicate increasing population during the Tarxien Temple phase (2002: 209). As explained by Trump, things are no better from this point of view for the Tarxien Cemetery phase, although interestingly there is evidence of continuity from the previous period at the Xaghra Circle (Trump 2002: 255), and of some temples being occupied by 'squatters' (Trump 2002: 239). There is no evidence of warfare in the Temple period, but daggers become very abundant in the Tarxien Cemetery phase (Trump 2002: 239), and the settlement record for the period following it (later in the 2nd millennium, Borg-in-Nadur/Bahrija phase) betrays a preference for naturally defended positions and possibly a demographic decline (Stoddart 1999a: 142, 1999b: 70).

In the light of the almost total lack of settlement evidence, the only real evidence for abandonment comes from the site of Tarxien Temple itself, where a 50-cm thick layer of sterile silt was found between the Temple and Cemetery layers (Trump 2002: 286). Trump himself pointed out that this could be the result of natural accumulation following a heavy rainstorm (*ibid.*). The other possible hints come from the Xaghra hypogeum, where the Tarxien Temple phase appears to be 'sealed off' (Trump 2002: 239), and from Skorba, where the 2-m thick stratigraphy of continuous occupation lasting ca. 2500 years from about 5000 cal.BC appears to stop abruptly (Trump 2002: 58). Dixon, however, claims that evidence from other sites (e.g. Borg- in-Nadur) and from Skorba itself points towards their continuous use, with material from both periods found together, and at least once in a sealed deposit (1998: 48). Stoddart also supports the idea of continuity with evidence from all three Tarxien temples, which demonstrate that the sites were transformed or 're-interpreted' rather than forgotten or destroyed (Trump 2002: 238), as can be seen from the fact that Tarxien itself became a cemetery, and that the Xaghra hypogeum, the temple at Borg-in-Nadur, and Skorba all became domestic sites (Stoddart 1999a: 141, 1999b: 70; Trump 2002: 239). Dixon believes that, in spite of clear differences, there is evidence for population continuity between the two periods but also of 'a religious and perhaps political metamorphosis' (1998: 47).

Recently, however, Leighton (1999) and Trump (2002) have revived the population replacement theory. In the Tarxien Cemetery phase, Malta displays close cultural parallels to Sicily once again (evident in the appearance of cremation, the use of monochrome incised ware, the first clear evidence for copper alloys, and the demise of temple construction itself) (Stoddart 1999a: 141; Trump 2002: 242). Leighton and Trump explained these changes, which occurred in both the mortuary and the daily sphere, by the arrival of new people, who, in the light of the introduction of dolmens (Fig. 7.18) onto the island at this time and other cultural parallels, may have come from either southern Italy and southern Sicily (Leighton 1999: 137), or from Sicily, Western Greece, or Dalmatia (Trump 2002: 248). Trump suggests that tensions between the priesthood responsible for the temples and an overworked population (combined with pressure on resources) may have caused the collapse of the Temple rituals, and concludes, on the basis of the much lower pottery densities for this period (Trump 2002: 252), that 'improbable as it may seem, it is as if the islands were abandoned utterly and stood empty as when the first intrepid seafarers came ashore 2,500 years earlier' (Trump 2002: 245).

The evidence just discussed supports some striking cultural changes and even the possibility of an influx of new people at this time cannot be entirely ruled out, but it not sufficient to sustain the idea that the islands were completely abandoned and subsequently recolonised. Robb (2001) has recently provided a valid framework in which to place and explain these transformations in Maltese society, which he believes are likely to have stemmed not from environmental constraints but from the islanders' changing attitudes to insularity itself or from the development of 'cultural difference' (2001: 192), evident in the increasing regionalism of the island's material culture (2001: 188). Robb argues that the development of the temples was a gradual and continuous process, which went through several phases of 'remodelling' (2001: 181), and that even during the Temple phase there is evidence of 'necessary and regular' contacts (2001: 188) between Malta and Sicily (2001: 183, 186-188). Trump also mentions that relations with Sicily continued throughout this time, as is evident from the importation of raw materials, but also of exotic goods (2002: 210-12). This indirectly dismisses the necessity of immigration to explain the reappearance of exchanged objects in the Tarxien Cemetery phase (since it would appear that this exchange never ceased). In fact there is no indisputable evidence of a physical abandonment of the island, but activities related to a certain way of living were set aside or perhaps reshaped and incorporated within a changed social order.

Another possible gap in Malta's archaeological record comes just before the island was occupied by the Phoenicians and is based on stratigraphic discontinuity at Tas-Silg (Brusasco 1993). Stoddart again claims that this by itself cannot support an abandonment scenario, but a change in settlement patterns at this stage seems confirmed by the emergence of single centres on both Malta and Gozo, indicating that population levels were low, which facilitated the Phoenician take-over of the islands (1999a: 142). Subsequently, Malta has been occupied continuously, while suffering a similar series of events as those described for the Aeolian Islands: it suffered destruction by the Romans in the first Punic war (ca. 255 BC) and was incorporated by Rome in 218 BC, though it kept a strong Punic culture for ca. two centuries (Stoddart 1999a: 143, 145). The island was conquered by the Arabs at the end of the 9th c. AD, when population levels dropped to less than 10,000 (Stoddart 1999a: 144). By the 15th c. AD, population had reached ca. 20,000 (Blouet 1984: 39; Fiorini 1993), and from then on it has continued to grow, in spite of famines, epidemics, and raids (*ibid.*). In the light of this review, it would appear that Malta displays a remarkably continuous occupation record.

JERBA

Jerba is a large island lying just off the coast of south-eastern Tunisia. It has a surface of 568 sq km, and a maximum altitude of 40 m a.s.l.. The annual rainfall regime is amongst the lowest in the whole Mediterranean basin (200 mm). The island has no springs but the water-table is reached through wells (particularly in the north-east) and several cisterns are used to collect rain (Fentress 2000, 2001). Soils are very fertile (the island is known for its olive groves), especially in the plains along the south-eastern and south-western coasts (*ibid.*).

The island has been the object of intensive survey directed by Drine, Fentress, and Holod (Drine *et al.* forthcoming). The survey covered 78 sq km. The earliest identifiable pottery on the island (from three coastal sites/ports and one inland site, the largest) dates to the 4th c. BC, from which point on Jerba appears to have been inhabited continuously. Interest in the island may be related to the fact that from there people could reach the mainland easily, while maintaining a naturally protected position, which is typical of Punic settlement (cf. the islands of Arwad, Tyre, Motya, and Mogador) (Fentress 2001). The absence of earlier pottery is striking, although, according to Fentress, this can be explained by the absolute lack of surface water, and the difficulties of making the short crossing (tides here are the highest in the Mediterranean, see Chapter 2).

Continuous occupation can be explained by the fact that in historical times the island provided a useful stop-over in the sea trade routes from Leptis Magna (Lybia) to northern Tunisia, a role which continued throughout the Middle Ages (Fentress 2001). The Kharejites, or Ibadis, settled on the island from the 9th c. AD onwards, and Berbers from this Islamic sect still form the main population, while until 1967 a substantial Jewish community (claiming to have arrived after the first Diaspora) lived in two villages (*ibid.*).

PANTELLERIA

The volcanic island of Pantelleria lies ca. 100 km south-east of Sicily. It has a surface of 83 sq km and a maximum altitude of 836 m a.s.l., the coast is 50 km long, and annual rainfall is 350 mm. The island lacks water sources, which is however compensated for by the fertility of its soils, allowing the growing of wheat, vines, and olives (Giannitrapani in http://archeoclub.pantelleria.it/considerazionibugeber.html).

Tusa (1997: 389) argues that Pantelleria was already populated in the 5th mill. cal. BC, on the basis of obsidian found in Neolithic contexts in Malta and Sicily (Camps 1988: 47; Cherry 1990: 191). However, this phase appears unrelated to the island's later settlement and these indications are more likely to reflect a phase of utilisation of the island without the need for permanent occupation (see Chapter 5). The earliest known remains of permanent settlement on Pantelleria are the village of Mursia and its adjacent cemetery, dated to the EBA, which were in use between ca. 2000 and 1400 cal. BC (Tozzi 1968, 1978). The next known remains from the island are Punic in date (7th c. BC), and no evidence has been found for the MBA, LBA, and EIA, in spite of intensive survey in the past few years. This is striking in view of the island's location along important sea routes, and of the evidence for contacts with Sicily and the Aeolian Islands in the previous EBA (Tusa 1983: 276), although, in the light of current knowledge, there may not have been a permanent population on the island for ca. 700 years, after which continuous occupation resumed to the present day (Tusa 1997).

PALMAROLA

The small island of Palmarola covers an area of ca. 1.4 sq km and has a maximum altitude of 250 m a.s.l. It lacks ground water, but rainfall is sufficient to support vegetation. The island lies close to the Italian mainland (30 km) and is part of the Ponziane archipelago. It is one of the four obsidian sources in the western Mediterranean, which is why it is included in this study. Obsidian procurement on Palmarola started as early as the Early Neolithic and peaked in the Middle-Late Neolithic (Tykot 1996: 61). There is indirect evidence that humans visited the island sporadically in the 4th mill. cal. BC, in the form of obsidian from Palmarola found in northern, central, and southeastern peninsular Italy (Tykot 1996: 43, 57). Tykot mentiones that the island has obsidian sources at Punta Vardella (in the south-east) and to the south of Monte Tramontana (1996: 43). Most obsidian found in the Tuscan archipelago is actually from Sardinia; however, Tykot believes that the obsidian found on the island of Giglio is from Palmarola (1996: 54). In the 12th and 11th centuries BC the island was used as a stop over by the Phoenicians. In the 1700s AD the island was used as a pirate base. It is uninhabited in the present day (De Rossi 1993; Mazzoli 1998).

TREMITI

The Tremiti islands lie in the south-east Adriatic ca. 20 km off the Italian coast. The largest, San Domino, covers an area of just over 2 sq km, and has a maximum elevation of 116 m a.s.l., while San Nicola is less than half a square kilometre in size (75 m a.s.l.). Two smaller islets (Cretaccio and Capraia) are part of the group (Fig. 7.19). The islands lack ground water and the vegetation has adapted to the saline geology and to being often submerged at high tide. San Domino has a dense Aleppo pinewood (*Pinus halepensis*) (Fig. 7.20) and also mixed holm-oak woods (*Quercus ilex*). The current land-use of the two main islands has changed since the 1950s, when all the population resided in San Nicola and went to San Domino only during the day for farming and herding (http://tremiti.planetek.it).

The islands display a remarkable settlement record in spite of their low biogeographic potential. A few isolated finds possibly indicate early sporadic human presence in the islands: a possible Early Neolithic ceramic and lithic scatter on the north-eastern part San Nicola (Fusco 1964: 194) and a large flint artefact (whose pre-Neolithic status is debated) on the islet of Cretaccio (Fusco 1964: 192). Permanent settlement began on San Domino in the Early Neolithic (Prato Don Michele), and appears to have continued in the Middle and Late Neolithic (Zorzi 1950, 1954, 1955a, 1955b, 1958, 1959, 1960). An amateur archaeologist also mentions the presence of a Copper Age hypogeum (Fumo 1980: 14). No further finds are known from the island.

The earliest signs of permanent occupation on San Nicola are the remains of a settlement dated to the Iron Age (9^{th}-7^{th} c. BC). Following this, there is a group of graves, one of which was dated to the Classical and Hellenistic Age (5^{th}-4^{th} c. BC), the remains of a Hellenistic settlement, and of two Roman houses. From the 11^{th} c. AD on, the island was settled by monks, who suffered several incursions by Slav pirates and were massacred in a raid in 1334, after which the island was uninhabited for some time, to be resettled only in 1412 (http://tremiti.planetek.it) (Fig. 7.21).

On the basis of the evidence just discussed, it appears that initial occupation of the Tremiti archipelago focused on the island of San Domino, which is the only island in this group to produce evidence for permanent settlement, in the form of hut and burial remains dated to different phases of the Neolithic. No radiocarbon dates are available for these sites, which are dated on the basis of pottery typology. Because these pottery phases can last up to a thousand years, it is hard to establish how continuous occupation actually was. However, a general impression of continuity can be sketched: the village of Prato Don Michele yielded Impressed Ware, which is generally dated to the 7^{th}-6^{th} millennium cal. BC; the Cala Tramontana settlement produced Ripoli Trichrome and Scaloria ware (or Apulian Trichrome Ware) (usually dated to the 5^{th}-4^{th} mill. cal. BC); another settlement in the pine wood near Cala degli Inglesi produced Serra D'Alto pottery (also 5^{th}-4^{th} mill. cal. BC); the Cala Tramontana burial site (dug into earlier settlement levels) revealed Diana-Bellavista ware (4^{th} mill. cal. BC). Collectively, the sites can be taken to indicate sustained occupation on the island until the 4^{th} and perhaps into the 3^{rd} millennium cal. BC, if the report of the Copper Age hypogeum is considered. In the 1^{st} millennium cal. BC, occupation shifted to the nearby island of San Nicola, following a gap lasting between two and three thousand years (if the surface scatter is considered). Interestingly, this situation changed again as recently as 1950, when population moved back to San Domino, so that people now live on both islands, on a more permanent basis in San Nicola, and on a more seasonal basis in San Domino (linked to the tourist industry).

DATA ANALYSIS

In this section the occupation and abandonment data from the islands are analysed within a comparative framework. Four types of analysis are carried out. The first looks at all the islands from the case studies and aims to assess overall patterns and establish whether or not islands that display similar physical characteristics also have similar occupational history. If not, it investigates what other causes may have been responsible for this variation. The second study focuses on the development of four islands that are also obsidian sources in the Mediterranean, in order to investigate to what extent the presence of resources alters the predictions based on the results from the previous analysis; thirdly, the development of islands smaller than 10 sq km is investigated, in order to assess whether or not, in the Mediterranean, small size and abandonment are related; and finally islands which are less than 50 km away from the nearest mainland (NM) are analysed to assess the role played by distance.

As a first step, the occupational data already discussed in the individual sections have been represented graphically as time-lines or "chronograms" (Figs. 7.22-7.30). Different periods of human use of the islands have been marked on a horizontal axis (the numbers indicate millennia BC and AD), through either a continuous line (=definite occupation) or a dotted line (=sporadic occupation). A gap represents definite abandonment, while a question mark indicates possible abandonment. The data are also summarised in Table 7.1, which contains information regarding the islands' size, maximum altitude, distance to nearest mainland, distance to the nearest other island, presence of water sources and mineral resources, annual rainfall, and population estimates at selected minimum densities. For convenience, separate tables and chronograms contain the same information for the obsidian islands and for the small islands.

STUDY 1. Assessing the Patterns

The following observations can be made after looking at the chronograms of all the islands together (Figs. 7.22-7.27):

1. the islands of Kythera, Melos, and Kea were abandoned between ca. 1100 and 800-700 BC; occupation on Naxos was drastically reduced to a single site during the same period (Fig. 7.22);
2. Kythera and Kea were also abandoned between AD 650-1100 and AD 800-1100 respectively. These two islands lie very close to mainland Greece (15 km and 22 km), which probably exposed them to events on the mainland (Fig. 7.22);
3. in the central Adriatic, Palagruža and Hvar were both abandoned after ca. 1800 BC (Fig. 7.24); abandonment lasted longer on smaller and more distant Palagruža;
4. in the Pitiussae islands, Ibiza and Formentera were abandoned after ca. 1300 BC; abandonment lasted longer on Formentera;
5. in the Aeolian islands, Panarea, Salina, and Filicudi were all abandoned after ca. 3500 BC. Abandonment lasted ca. 500 years on Panarea, and up to a thousand years on Salina and Filicudi; these three islands and Stròmboli were abandoned between ca. 1500-1200 BC and the mid-1st millennium AD (Fig. 7.26);

The two phases of potential abandonment noted in the Greek islands are discussed in the following sections in some detail (Fig. 7.22): the time-lines of Kythera, Melos, and Kea show an occupational gap between ca. 1050 BC and ca. 800 BC. North-west Kea appears to have been abandoned between about 2200-1900 cal. BC. The other islands were occupied at this time (overall), but some sites were destroyed at this time (Doumas 1992). The analysis starts with this earlier potential 'gap'.

Regional Patterns

Greek Islands: the 2200-1900 cal. BC 'gap'

Although the settlement discontinuity on Kea is not paralleled on any of the other islands in the current study, there is an ongoing debate regarding a potential Cycladic 'gap' or a generalised occupation decline at this time in the Cyclades (Rutter 1983, 1984; Manning 1997). Broodbank (2000: 320) has recently addressed the subject: the main issue in relation to the Cycladic 'gap' is whether or not there was some degree of settlement continuity between the preceding and subsequent periods (Broodbank 2000: 332). The late 3rd millennium cal. BC saw the demise of the Akkadian empire, Old Kingdom Egypt, and Levantine urbanism, and on a much smaller scale this may have affected some of the islands (e.g. the sites of Ayia Irini on Kea, Panermos on Naxos, and Markiani on Amorgos). However, this decline was succeeded in the early 2nd millennium by the emergence of Palace-states and the islands' increasing involvement in the Minoan world (Broodbank 2000: 325).

Broodbank has argued that the archaeological evidence for discontinuity in the Cyclades during the 2200-1900 BC period indicates a change in the islanders' way of life and not necessarily overall abandonment, since there is also evidence for continuity at individual settlements (outside the Cyclades), such as on Aegina, Skyros, Samos, and possibly Kos and Rhodes (2000: 320). Rutter (1984) has also rejected the idea of total abandonment of the islands, which is based on just a few sites. Ayia Irini on Kea provides the only indisputable evidence for abandonment (between periods III and IV) and Broodbank singles it out as being a special case, as the site was still abandoned in the early MBA, i.e. when the other abandoned sites were reoccupied (2000: 334). Broodbank concludes that this evidence is not sufficient to claim total abandonment and that, on the contrary, although there were signs of localised decline between EBII and MBA, there is evidence of settlement continuity in some islands during EBIII (2000: 335).

Evidence from Kythera supports this hypothesis. The island shows no sign of decline or abandonment at this time, though there were changes. Most notably, the site of Kastri, a potential Cretan 'colony' (Broodbank 2000: 354) continued, and a Peak Sanctuary, the only one known so far outside Crete (Sakellarakis 1996), emerged on the island in EBIII or at the start of MBA (ca. 2200-1900 BC). This Cretan presence suggests a process of internal reorganisation, which may have taken place more readily on

Kythera, as it lies close to Crete and acts as a stepping-stone island between the latter and the Peloponnese. Elsewhere this process may have taken longer, or not at all, resulting either in an 'interstitial' phase of change (Broodbank 2000: 323), i.e. a period characterised by a fuzzier pattern of settlements and material culture (*ibid.*), or in actual abandonment. Island societies would have dealt with the rise of Cretan influence, which made them in effect 'a periphery zone of the Minoan Palaces' (Broodbank 2000: 350), in different ways. Cretan influence would not have been the only factor: increased aridity, land degradation, demographic changes, internal competition, conflict, and improved sea-faring may have provided the *coup de grâce* to island societies (e.g. Kea) already stretched beyond their carrying capacity (Broodbank 2000: 340-1). Although the data from Kea support the hypothesis that this island was abandoned at this time, there is not sufficient evidence in other areas to substantiate the idea of a more generalised Cycladic gap.

Cherry *et al.* (1991), who discussed in detail the diverging cultural trajectories of Kea and Melos, noted that although the two islands have comparable sizes and environments their settlement histories are different. They explained this, to some extent, by the fact that Kea lies very close to Attica. The Kea survey was able to establish that central places were created in northern Kea three or four times, often as new foundations. Cherry *et al.* (1991a: 7) have suggested that the island's proximity to Attica may have prevented continuous development at Ayia Irini and on Kea generally.

Greek Islands: the 1050-800 cal. BC 'gap'

As noted above, Kythera, Melos, and Kea were abandoned between ca. 1100 and 700 BC, while only Grotta seem to have been occupied on Naxos during this same phase. This period falls between the end of the Mycenaean Palaces (start of the Post-palatial period) and the rise of Archaic Greece. Supposedly it came to an end with the arrival of a new group of inhabitants and it has traditionally been seen as a phase of cultural involution leading to a 'dark' age. According to Snodgrass and other researchers, this phase saw a drop in demography, a decline in material skills and arts (writing, in particular), and 'a general fall in living standards' (Snodgrass 1971: 2; Osborne 1996: 30-31; Whitley 2001: 77). Osborne distinguishes between the decline of the Palaces and of the people, who although impoverished continued to live for another hundred years according to Mycenaean traditions (LHIIIC or Late Minoan III C period) (e.g. Perati in Attica, Ialysos on Rhodes, and Emborio on Chios) (Snodgrass 1989: 23; Osborne 1996: 21; Whitley 2001: 77, 79). Although Osborne excludes wide-scale abandonment in the Greek peninsula, he points to a dearth of sites ca. 1200 cal. BC, when compared to the immediately preceding period (1996: 19). According to Whitley (2001: 79), survey data since the early 1970s support the figures from Snodgrass (1971) and a dramatic reduction in the number of occupied sites in the Aegean area, which in turn has been taken to indicate an overall fall in population (inferred from both lack of sites and cemetery data) lasting until ca. 800 BC (Snodgrass 1971: 364-5; Osborne 1996: 23; Whitley 2001: 80).

Snodgrass explains that in most cases decline occurred in the later part of the 12th c. BC, while abandonment may have lasted into the 11th- 10th c. BC (*ibid.*), which corresponds well with the data from Kythera, Melos, and Kea. Osborne confirms this hypothesis, noting that 'the material evidence for the two centuries after 1050 BC is one of successive failures to establish any extensive, political, economic, or social organisation' (1996: 28). At the same time, however, several sites (e.g. Lefkandi, Tiryns, Argos, Athens, Grotta on Naxos, and Mycenae itself) indicate that Mycenaean communities survived (Snodgrass 1971: 368; Osborne 1996: 20-1). Many 'refugee' sites were founded from 1250 BC onward in remote defensible places, such as Karphi in Crete, mostly to be abandoned by ca. 1000 BC (Osborne 1996: 49; Whitley 2001: 78). It is evident that Mycenaean cultural traits did not disappear altogether, but that the collapse of the Mycenaean power structure had different effects on the Greek islands. Settlement history on Naxos, for example, is on the whole more successful than on most other islands: as we saw, in the 2nd millennium cal. BC, the island had three large settlements, when population in most other islands was concentrated at a single site (Hadjianastasiou 1989, 1993; Barber and Hadjanastasiou 1989). The obvious explanation for this is that Naxos lies in a central position within the Cyclades and benefits from abundant resources. These favourable biogeographic characteristics allowed the island's initial settlement to be followed by the establishment and consolidation of its population, which could be sustained in the long term. Nonetheless, like several other Cycladic islands, Naxos suffered periods of decline. It is possible that - in this case - the increased involvement of the people of Naxos in broader networks made them more vulnerable than in the Neolithic, when they were not yet tied into such networks (Broodbank 2000: 320).

Overall Patterns

Further information can be drawn from tables relating to this study (Tables 7.4-7.5), particularly in terms of estimating the relative length of occupation and abandonment. Table 7.4 shows that, on average, occupation lasted longer than abandonment (approximately 4500 years vs. 1500 years per island). The average occupation period was in the order of just under 2000 years, while the average abandonment period lasted ca. 1000 years. The first occupation period for most of the islands was usually long (more than 1000 years), except in three cases (marked in red): Formentera, Ibiza, and Cyprus. For Cyprus this is because the short initial occupation relates to Akrotiri-*Aetokremnos*, but if that is not included, then the initial occupation period lasts much longer (3000 years), which is what one would perhaps expect on such a large island. It is striking that the initial occupation of the Pitiussae islands was so short, although estimates for Alicudi and Pantelleria (both 1000 years) may also be too high.

Abandonment periods lasted anything between 5000 years (San Domino) (which may reflect an anomaly in the island's study, marked in red), or perhaps more likely 2500 years (cf. Palagruža, Stròmboli, and Alicudi - averaged), and 200 years (San Nicola, marked in red). The data from Table 7.5 indicate that on average prehistoric abandonment lasted ca. 800 years. This figure can be compared with Butzer's (1996: 146) observation that settlement surveys in some Mediterranean regions have recorded occupational gaps lasting between 500-1000 years (see Chapter 6). During the first two millennia AD, the length of abandonment periods is much shorter (generally lasting ca. 300 years), while on average each island in the sample was abandoned for about a century during historical times. Islands were also abandoned during the BC/AD interface and at this stage abandonment periods appear to be remarkably long (ca. 2000 years), though slightly less so if San Domino is excluded (ca. 1600 years).

Overall, Table 7.5 also shows that islands colonised early (6^{th}-4^{th} mill. cal. BC) generally experienced initial occupation periods that lasted longer than those colonised later (3^{rd}-2^{nd} mill. cal. BC). Initial occupation periods on islands colonised later ranged between ca. 3000 (San Nicola) and 700 years (Formentera), or ca. 800 years on average per island; whereas occupation on islands colonised earlier varied between ca. 5000 (Lipari) and 1000 years (Palagruža), or ca. 2250 years on average per island. On the other hand, abandonment periods vary in length (between 300 and 2500 years) throughout prehistory with no apparent patterning with regard to the period of initial occupation or to the islands' size and distance (with Cyprus, for example, experiencing longer abandonment periods than Lìpari).

The fact that islands settled later were occupied for shorter periods raises important questions and requires some explanation. Although based on a sample of just 20 islands, the observation cannot be easily dismissed: while logically islands occupied in the 6^{th} millennium BC can be occupied longer than islands occupied in the 3^{rd}, the fact remains that islands colonised later *were* in fact abandoned. Following the reasoning above, or assuming there was no trend, we would expect them not to have been abandoned yet (or perhaps after ca. 2000 years), but this is not the case. The fact that islands colonised later were abandoned sooner may thus reflect the fact that these tended to be smaller or less favourable to prolonged occupation than those occupied in earlier periods. The trend may also echo changes in the use of the islands over time - use that by the Bronze and Iron Ages had become increasingly specialised and thus tied in with socio-cultural processes of a more contingent nature than before. Importantly, as we saw in Chapter 2, it was at this time that maritime transportation became easier, thanks to the introduction of sail technology at the end of the 3^{rd} millennium BC.

STUDY 2. Assessing Resources: Obsidian Islands

This study focuses on four islands that are also obsidian sources. They are, in order of increasing size, Palmarola, Lìpari, Pantelleria, and Melos. The chronogram (Fig. 7.28) shows remarkable similarities in the islands' occupational history: Lìpari and Palmarola (which share the same distance from their nearest mainland and are both part of archipelagos) display a continuous human record (actual settlement in the case of Lìpari and sporadic settlement and visitation in the case of Palmarola), in spite of the fact that obsidian had practically gone out of use by the end of the Middle Bronze Age. Both islands experienced a period of instability in the early historic period (related to pirate incursions). Pantelleria and Melos also show some similarities: both islands are quite large and far from the mainland, but Melos is part of an island group whereas Pantelleria is isolated. They both experienced a period of abandonment in the mid- to late-2nd millennium cal. BC, when the two primate sites on the islands (the Bronze Age villages of Mursia and Phylakopi) were abandoned, a period lasting approximately until 700 BC. Melos also experienced a partial abandonment/decline around 600-800 AD, much as Lìpari did (caused by widespread pirate raids in the Mediterranean).

When we view the first table for this study (Table 7.6), we note that, on average, occupation periods on the islands (ca. 2250 years) were much longer than abandonment periods (ca. 450 years). This is true even if Palmarola is excluded, as its occupation record does not relate to permanent settlement (ca. 1900 years vs. 240 years). If the islands are viewed two at a time (Tables 7.7 and 7.8), it emerges that the two smaller (Lìpari and Palmarola) experienced slightly longer occupation (ca. 2800 years) and shorter abandonment (350 years) periods (they are also the closest to their respective mainlands). Pantelleria and Melos, which are the largest, experienced slightly shorter periods of occupation than the smaller ones (ca. 2300 years) and twice as long abandonment periods (ca. 700 years). This is mainly due to the effect of Pantelleria's isolation, as individual abandonment figures in the Table for the two islands indicate, but also to the high value attributed to Palmarola. If the island is excluded, it emerges that the two larger islands, Pantelleria and Melos, experienced longer occupation periods than the small ones. In addition, the abandonment periods of Lìpari and Melos are similar in length (350 and 400 years respectively).

STUDY 3. Assessing the Impact of Size: Islands smaller than 10 sq km

Moving on to analysing the islands in the sample that are smaller than 10 sq km, the following observations can be made after looking at the chronograms (Fig. 7.29): the only island that displays continuous occupation is Palmarola, but this is explained by the fact that this occupation relates to a palimpsest of sporadic occupation, as opposed to continuous settlement, and by the fact that it is the only island in the sample with a valuable mineral resource. The similarities already noted between Panarea and Filicudi were explained by the islands' configuration and reliance on nearby Salina. The island with the shortest occupation is Alicudi, which is not the smallest in the sample but the furthest from the nearest mainland, and has very little land suitable for settlement (it is an ancient volcano): in this case, it seems that the network of assistance within the Aeolian archipelago may have become weaker as it moved away from Lìpari to its periphery, Alicudi, via Salina and Filicudi.

If we look at the table for this study (Table 7.9), it is worth noticing that the average occupation period for these islands is ca. 1700 years, whereas the average abandonment period is ca. 1800 years, which means that, unlike what happens when *all* the islands are considered (Study 1, Table 7.4), on average, occupation periods were shorter (ca. 1700 vs. 2000 yrs) and abandonment periods were longer (ca. 1800 vs. 1000 yrs) on the smaller islands. Abandonment periods lasted slightly longer than occupation on these islands, which is the opposite to the general trend noted for the islands in the overall sample (see "Overall Patterns"). This may result from their size but also from a combination of other factors: although rainfall is adequate and a few have fertile soils, none of the small islands in question has water sources.

STUDY 4. Assessing Distance: Islands with Dist. NM ≤ 50 km

Finally, this section focuses on the effect of distance on the islands. Fifty km was taken as representing a convenient break in the sample, but when translated into days of maritime travel (in favourable conditions), this distance is equivalent to two and a half canoe days or one longboat day (Broodbank 2000: 287). With 20 km being the distance a canoe can cover in one day (*ibid.*), it becomes clear than any journey beyond 50 km would involve planning and expose travellers to increased danger. Stròmboli and Alicudi have been included in this group, although they are more than 50 km away from the nearest mainland. This is because they are the only islands in the sample lying at less than a day away from nearby islands (Panarea and Filicudi respectively) that in turn are less than 20 km away from the nearest mainland ("stepping-stone" effect). Although most of the islands excluded from Table 7.10 lie close to other islands (generally much less than 20 km), apart from Pantelleria and Cyprus (ca. 70 km), all the islands in Table 7.11 lie close to islands that in turn are distant (>20 km) from their nearest mainland. The study will compare the two groups (Fig. 7.30 shows islands <50 km NM).

The following observations can be made when looking at Tables 7.10 and 7.11: on average, for the first group of islands, occupation periods lasted longer than abandonment (ca. 1700 vs. 1100 years). The same applies to the second group, but here occupation actually lasted longer (on average ca. 2600 years), and abandonment periods were shorter (ca. 650 years). On average, the islands in the second group are by far larger than those in the first group and most have water sources or mineral resources (or both). This combination of factors may have been more influential than distance alone, and thus explain why these islands experienced longer occupation and shorter abandonment periods.

CONCLUSIONS

The case studies have highlighted the fact that, while knowledge about islands and itineraries could be accumulated, island life was not always continuous, i.e. 'knowledge', as constructed through visits over time, and settlement history were not always related. At the same time, however, there is a striking relationship between islands being visited/settled early (6^{th}-4^{th} mill. cal. BC) and initial settlement continuity, a trend which changed in later periods (3^{rd}-1^{st} mill. cal BC), when there were large-scale changes in the Mediterranean (ranging from the development of sail technology to substantial political and economic transformations).

Abandonment has been over-emphasised qualitatively (it is generally seen with a catastrophe mind set) and it has not received systematic quantitative attention. It has been largely overlooked in Mediterranean island studies, particularly on a comparative level. There are obvious exceptions to this general lack of interest: the demise of Malta's Temple culture has long fascinated archaeologists and non-specialists alike; similarly, the prehistoric eruption of Thera, which prompted the abandonment of the island and had wide-spread consequences across the Aegean and beyond, has attracted much attention. However, there are other islands in the Mediterranean where less archaeologically visible evidence ceased to exist, requiring an investigation into the daily and ordinary. Considering that humans can adapt to a wide range of harsh environments, the fact that abandonment was sometimes selected (except in extreme cases, such as Thera) as an option also indicates that island environments were used/regarded by humans in similar ways to other territories that were abandoned, and that island abandonment should not be considered as radically 'different' from other forms of regional abandonment.

The case studies highlighted several points. Firstly, there are both advantages and disadvantages if we view islands as discrete study units. The study of individual islands can provide incredible detail, but this level of detail would be wasted unless the information gained from the unitary island is matched against other islands, in order to assess both their absolute and their relative importance and contribution. Focusing on individual islands showed that there are difficulties with establishing whether gaps in the data correspond to actual instances of abandonment. This is due to the very nature of archaeological research, which, very much like island life itself, is not continuous and all-encompassing. Nonetheless, this chapter selected a group of ca. 20 islands with a sufficiently complete archaeological record, so that occupation and abandonment could be investigated with a certain degree of confidence, based both on the reports of their original investigators and on the re-interpretation and re-assessment presented here.

As a general point, the review and the studies showed that, in the islands considered, environmental factors *per se* were not an obstacle to island life (overall, occupation was more continuous on Lìpari than on Cyprus). On the contrary, colonisers made the most of what they had. Lìpari is 'unusual' in view of its continuous occupation, and confirms that islanders can develop successful survival strategies if they are tied into networks. On the other hand, excessive involvement in networks and in non-reciprocal relations may also have had negative effects, exposing islanders to fluctuations in the networks themselves, as was perhaps the case for Naxos (cf. Henderson and Mangareva, see Chapter 6 [Weisler 1995: 380]).

Different 'types' of abandonment, requiring different kinds of analysis, emerged from the detailed review of individual islands and island groups. In the case of the Greek islands, the abandonment of large nucleated villages or small towns, sometimes occurring in parallel, was related to wider processes of socio-political change occurring on the Greek mainland, although it was highlighted how these affected the islands (and even individual sites) in different ways. For Cyprus, in the case of the Akrotiri inhabitants, the abandonment of the rock shelter was presented as forming part of a strategy of land use. Similarities emerged between Palagruža and Pantelleria, where abandonment was related to the changing roles of the island as providers of mineral resources and as maritime stop-overs; while on Hvar (as in the Greek islands), abandonment was again connected to processes on the mainland (particularly evident in the Cetina period and in the Roman period). Some important parallels were identified between the Pitiussae/Balearics and the Lìpari and Tremiti islands, in terms of expansion and contraction strategies within an archipelago. The abandonment of Malta after the Temple phase was rejected as an explanation for cultural transformation, and for Jerba it was noted that the island was inhabited continuously in spite of its low biogeographic appeal, but thanks to its favourable location (in the case of Palmarola, obsidian had a similar effect).

These distinctions between abandonment types are obviously not clear-cut, but their study managed to highlight at least some prominent factors.

The studies showed that resources played a more prominent role than distance and size in determining overall occupation and abandonment periods, with the presence of obsidian considerably reducing the length of abandonment periods experienced. On the other hand, islands smaller than 10 sq km, suffered slightly longer periods of abandonment, which can be related, albeit not exclusively, to their size.

Overall, it is evident that a number of different survival strategies were available to island communities facing difficulties. In the long run, some of these may even have been implemented as pre-emptive measures, if such difficulties could be anticipated and alternatives, whether real or perceived, were available. Risk can be solved in different ways, and in that respect, abandonment should thus be seen as a last resort. However, the abandonment of several islands in the recent past and in the present demonstrates that people abandon islands long before survival itself is at stake. The settlement evidence reviewed supports the idea that prehistoric communities had developed effective ways of capitalising on what little individual islands had to offer and that not all abandonment resulted from catastrophic scenarios. This strategy may have been effective in the long run, even if abandonment was never an easy option. With obvious caveats, it would seem that the general trend towards depopulation of the small Mediterranean islands in the present (Baggioni and Hache 2000) offers a parallel to what happened in prehistory, when the islands, including some large ones, were repeatedly abandoned and recolonised (before, during, and particularly after the Neolithic).

CHAPTER 8

ISLAND COLONISATION AND ABANDONMENT: ISSUES AND THEMES

Looking Back, Across, and Forward

This chapter is both a synthesis of the main results of this thesis and a reflection on my years of research, as it brings together issues and themes that have emerged over the course of this study and comments on how this work fits into the broader remit of Mediterranean prehistory.

This thesis aims to be a step forward in Mediterranean island archaeology on a number of accounts. At a basic but necessary level, it provides a critical update of all the data available on the earliest colonisation of the Mediterranean islands, marking a departure from previous pan-Mediterranean contributions to the subject, which have been largely based on Cherry's syntheses (1981, 1990). This work is also more comprehensive than previous ones, both from a geographical point of view, as it includes data from more islands (particularly in the Adriatic and along the North African coast), and from a temporal one, as the investigation extends beyond first colonisation to include abandonment and recolonisation. By widening the scope of the investigation in such ways, this research hopes to be thematically broader and theoretically substantial, as it deals with causes, processes, and effects in a comparative framework, thus providing a clearer picture of processes of colonisation within Mediterranean prehistory.

Many researchers have followed Cherry's lead in claiming that island colonisation was an irregular process, one that displayed a high level of 'noise', which was generally put down to either uneven exploration or the fact that 'chance' had contaminated the more regular pattern of human presence on islands as predicted on the basis of biogeographical variables (or both). As this study moved from the pan-Mediterranean and east-west level of analysis towards a regional scale of enquiry, it was able to gauge the relative importance of these factors, for example by identifying islands that have not been the focus of sufficient research and where this lack of study is likely to be responsible for the uneven patterns, or areas where biogeographical factors are really prominent, and finally areas where elements of a more contingent nature, such as specific historical conditions, as well as 'chance' or other factors that still subtly escape us, are likely to have been involved in shaping the patterns of prehistoric island colonisation. Clearer patterns emerge from the data as a result of the inclusion of abandonment and subsequent recolonisation: it is as much in the later as in the initial history of island colonisation that we see what factors were critical in the establishment of a human presence on islands, and it is by looking at this long-term island history across a broad geographical spectrum that the actual nature of the uneasy alliance between humans and island environments emerges convincingly.

The examples and case studies in this thesis demonstrate that prehistoric island encounters were diverse and illustrate different aspects of the relationship between humans and islands and its development over time and space. The fact that that these encounters appear to differ so greatly is what makes the Mediterranean stage so complex. However, at the same time, human development on islands appears to be built around a set of increasingly recurrent circumstances, which emerge in this study through the implementation of a comparative framework of enquiry, and which can be extrapolated and examined, for example, by focusing on specific categories of evidence. At the same time, this study points to the fact that island life is best gauged on a relative rather than an absolute scale of enquiry, which emphasises that concepts such as 'long-term' occupation or 'successful' colonisation have to be assessed on a case-by-case basis.

After approximately a hundred years of archaeological fieldwork in the Mediterranean, a number of recently published works, and others planned or in preparation, appear to be making an assessment of the main achievements of the discipline to date. Talking about 'Theory and practice in Mediterranean archaeology', Renfrew (2003: 316) noted not long ago that 'the lack of any useful comparative framework has made the quality of theory in our field rather poorer recently than it was thirty years ago', and went on to single out island archaeology as one of the few areas where fruitful comparison is being carried out in Mediterranean studies. However, this is not so straightforward, as island studies are still in a phase of self-definition and acceptance by the wider academic discourse (cf. Fitzpatrick 2004).

In a recent paper, McKechnie has argued that 'despite their objective physical nature, islands are conceptually vague' (2002: 128), a fact which makes it difficult to analyse them (2002: 127). In fact, islands are not 'vague' *per se*: it is rather the combined effect of the generally contrasting conceptualisations of islands and of what happens there, as seen by islanders and non-islanders (past and present), and by islanders and researchers, that results in this apparent blur. In order to counteract notions such as 'indifference' (cf. McKechnie 2002) and 'ambivalence' (cf. Anderson 2004) becoming excessively rooted in island studies, and to ensure that island archaeology maintains the space it has cut out for itself within the broader framework of Mediterranean archaeology, island archaeologists must introduce categories (be they spatial or cultural) to their studies. Mandryk (2003: xiv) has recently stated that 'colonization is a process, not an event' (cf. Nelson [2000: 55] on abandonment, see Chapter 6): thus the categories or variables in question depend on which aspect of the process we are interested in. For example, Cherry has recently underpinned the idea that 'worldwide correlations' indicate that biogeographical and cultural variables can provide a useful category for the study of islands in the Mediterranean (2004: 244). Any study of islands should make explicit what categories it selects, if it is to be widely useful and effectively explore the complexities posed by islands.

These complexities are reflected in the archaeological record and call for distinctions (and overlaps) between different types of activities and interaction (such as visitation, utilisation, seasonal occupation, permanent settlement, establishment, abandonment, and re-colonisation), which can usefully oppose monolithic categories such as 'colonisation' (see Chapters 3, 5, and 7). Gosden's definition of colonisation as a 'rearrangement of time and space as people re-order themselves and their world' (1993: 24; cf. Broodbank 2000: 110) captures well the complex nature of this process. Abandonment is an integral component of this process of re-ordering, as it involves, at a general level, success and vulnerability in island life but, more specifically, also the transformation of networks, through the interruption, transferral, and transformation of established activities and the movement of people involved in them.

Island archaeological theory has the potential to be improved through a practice of comparison, in which, as we have seen, the categories being compared depend on the questions being asked. On a more general level, Knapp has pointed out that cultural variability can be investigated through 'intercultural comparison of differences (in a context of similarities) and similarities (in a context of differences)' (1989: 189). The comparison of different island cultures has become increasingly popular, a trend which is apparent in recent archaeological symposia and literature, where not just regional but world-wide perspectives are being discussed (e.g. Waldren 2002; Fitzpatrick 2004). These global perspectives bring together not just island cultures that are thousands of miles apart but also archaeologists whose backgrounds are often very disparate. Through their different approaches, researchers tend to either present their islands as being representative of a wider phenomenon or as being intrinsically different. Some view islands as closed geographical and social laboratories, in which ecological variables are the determinant force in a functionalist culture evolutionary paradigm (the 'phylogenetic' approach) (e.g. Kennett and Clifford 2004; Erlandson *et al.* 2004), while others temper environmental determinism by blending together cultural and natural factors and locating islands within networks of interaction (the 'reticulate' approach) (e.g. Fitzpatrick and Diveley 2004; White 2004; Terrell 2004) (see Dawson 2003 and Cooper and Dawson forthcoming for a critique).

This study belongs more in the reticulate tradition, but recognises the usefulness of other approaches. It treats islands as a basic unit of study, but goes on to examine different combinations of more complex units (site-island, island-island, island-mainland), initially by gauging the role of biogeographical variables (island size, distance, resources, and configuration), and subsequently by reviewing other factors. The latter include people's perception of the environment and of demographic sustainability, or the potential allure or 'pull' (Anthony 1997) of other islands and mainlands. The resulting observation is that different (though occasionally recurrent) combinations of factors (some more constant, others contingent, some measurable, others ephemeral, some archaeologically visible, others not) contribute to the making of human histories on islands.

As this study proceeded, it became increasingly evident that colonisation includes a number of complexly related activities, constituting a spectrum that can hardly be encapsulated as a sequence of arrivals and departures. As Broodbank has pointed out, colonisation is a 'convenient short-hand term as long as we remain alert to the range of things that it can signify, and the variety of antecedent and subsequent activities that bracket it' (2000: 110; cf. Mandryk 2003: xiii). It is easy to see how these words are equally applicable to 'abandonment'. Looking back, the structure of this thesis (with separate chapters dealing with colonisation and abandonment theories) is reflective to an extent of the way in which island colonisation has been studied until now. 'Abandonment' did not figure in the original title of the thesis, which was initially concerned with understanding 'colonisation'. Eventually, 'colonisation' was kept in the title and 'abandonment' added, as both terms are familiar enough to allow one to scrutinise a series of activities which took place on the islands and distance oneself from inadequate interpretations of these processes. One of the aims of this thesis was to capture these activities and to explore, as far as possible, how they are articulated as a whole, but also to theorise colonisation and abandonment by analysing the data in the light of past and present ideas developed both within and outside the Mediterranean. With the hindsight offered by my years of study, it would be both a challenge and an achievement to write a unified theory of colonisation and abandonment under a single heading. However, this could not be done without the insights offered by the present study, as this thesis intends to clarify the complexity of colonisation and abandonment and to demonstrate the actual benefits of a joint study.

This thesis has explored the advantages of viewing colonisation and abandonment processes in parallel (particularly in the final part of Chapter 5 and in Chapter 7), by focusing on the occupational histories of a number of islands. Chapter 7, whose original title was 'Abandonment Data Analysis', gradually evolved into a comprehensive investigation of *circa* twenty Mediterranean islands, as it became evident that their colonisation, abandonment, and recolonisation histories could not be studied in isolation. The inclusion of abandonment and the aspiration, where possible, to follow the long-term history of not just individual islands but several islands together (even when people were absent) is what sets aside this study from previous treatments of island colonisation. The way colonisation is viewed in this thesis is also (it is hoped) more comprehensive, as it shows that the presence of people on an island, or indeed their absence, takes place in different contexts.

Horden and Purcell (2000: 5) have stated that 'the distinctiveness of Mediterranean history results...from the paradoxical coexistence of a milieu of relatively easy seaborne communications with a quite unusual fragmented topography of microregions in the sea's coastlands and islands'. While the outcome of this may be that Mediterranean history appears to be largely unpredictable, reflecting as it does a number of hidden causes for people's 'coming and goings' to islands, some elements are recurrent and can be investigated. Starting from empirical observation, an island's geographical features can be used to map the search for territories and resources and to mark how these changed across time. Moving on from the empirical level, there is scope for theorising on less tangible categories, such as the role of knowledge (e.g. its acquisition and sharing) in these processes, by drawing upon interpretations and accounts of both prehistoric and historical colonisation and abandonment from a variety of spatial backgrounds.

Mediterranean Island Colonisation and Abandonment: Issues and Themes

This section is not intended as a detailed summary of the thesis (for this, please refer to the introduction and to the conclusions to individual chapters) but rather as an appraisal of the main issues and themes resulting from the investigation overall. This thesis can be broadly divided into three parts: a theoretical evaluation (the review of past and current colonisation and abandonment theories, Chapters 3 and 6), an empirical study (the geographical and archaeological data analysis, Chapters 2, 4, 5, and 7), and a final proposal (the formulation of suggestions for Mediterranean island archaeological practice and theory, parts of Chapters 3, 5, and 7, and this chapter).

The initial theoretical review draws attention to the drawbacks and potential of both traditional and more recent approaches, and sets the scene in which to gauge the relevance of the archaeological sequences from the islands. The empirical stage of this study consists in the analysis of the archaeological and geographical data, through the matching of aligned temporal sequences of colonisation and abandonment processes through exploratory statistics (Chapter 5) and detailed descriptions of the islands' occupational histories (Chapter 7). During this phase of the investigation, similarities and differences were initially noted between the western, central, and eastern Mediterranean islands, then between island groups, and finally on a case-by-case basis, between individual islands. This allowed the study to investigate potential reasons for broad convergence and divergence, and increasingly more specific causes for the outcomes noted, which could be used to test prevailing theories.

Throughout this study, the all-important question has been whether any specific factors can be seen to be resulting in similar activities at different times, which may in turn lead us to understand whether colonisation and abandonment of different islands (and island regions) are interconnected, either directly (historically linked) or indirectly (causally linked by similar factors). This issue, it is argued, can be addressed effectively through a comparative approach. This comparison has led to the identification of a series of spatial patterns whose significance can be evaluated. For example, reasons behind chronological variation can be addressed in terms of both absolute and relative dating (e.g. the study compared both very early and very late initial colonisation/abandonment dates and relative lengths of occupation and abandonment periods). The investigation of these patterns demonstrates that, in general, there is some regularity in the colonisation trajectories when the islands are viewed collectively, but that a number of exceptions can be singled out when the analysis zooms into specific island groups. The Aegean basin is a good example, as it is host to islands in close proximity to each other, displaying synchronously important differences in their human use, both within the island groups themselves and between groups. Although there is some correspondence between biogeographical variables and the islands' occupational histories, elements of human choice formed under a variety of cultural conditions played an increasingly important role in the shaping of island life, both in the Aegean and elsewhere in the Mediterranean.

Differences were noted in the colonisation and abandonment trajectories of islands that shared geographical similarities, while similarities in the unfolding of such trajectories were also singled out among islands that could be considered as being physically rather different. It was the differences in both colonisation and abandonment sequences, rather than the similarities, that proved to be more informative, as they demonstrated that biogeography cannot account by itself for cultural divergence in the Mediterranean island context. As we saw in Chapter 5, island biogeography in the Mediterranean has a certain explanatory power but cannot generally be used in a predictive fashion. Nonetheless, it holds strong exploratory potential, as viewing the different geometric properties of islands, particularly their configuration, reveals the richness and variety of island-human encounters and highlights both choices and restrictions.

For example, the fact that in the western Mediterranean most islands colonised during the Neolithic were generally visible from the mainland or another large island (lying at less than 50 km from the nearest mainland) (e.g. the Lìpari islands and Malta) (Chapter 5) is likely to reflect some element of human choice in their selection and not just availability. Alternatives (i.e. other islands) were present, but either generally avoided or not known (being further away), suggesting that humans involved in these colonisation ventures were reluctant to brave the open sea or that perhaps they saw no need to. The fact that most distant islands (lying more than 50 km from the nearest mainland) were colonised either before or after the Neolithic (with small far-away islands colonised for the first time mainly from the Bronze Age onwards) (see Chapter 5) reinforces this possibility, and seems consistent with evidence from Lipari, where the lack of evidence for deep-sea forays has been taken to indicate that its Neolithic colonisers were concerned more with the resources offered by the land (obsidian and farming) than with exploiting the sea (Castagnino Berlinghieri 2002: 230, see Chapter 4).

The exception to the explanation above is of course Lampedusa, which, in view of its physical isolation, demonstrates that Neolithic people were engaged in a variety of activities, both land- and sea-focused. Elements of human choice are further illustrated by evidence from the eastern Mediterranean, where the overall analysis of colonisation data indicated that, during the Neolithic and Bronze Ages, islands seemed to have been selected on the basis of their size rather than of their distance. Islands targeted in the Neolithic were colonised regardless of distance but tend to be large (more than 20 sq km) (Chapter 5), although small close-by islands were also taken over from the 5^{th} millennium cal. BC onwards.

These overall observations reflect a palimpsest of trends, whereas specific decisions as to which islands to go to (either for settlement or for other activities) were likely to have been influenced by factors operating at the local level. For this reason, the study also focuses on individual islands, since these illustrate better how cultural elements interplay with environmental factors (Chapter 7). The review investigated how colonisation and abandonment/occupation data fit together by asking what was happening in surrounding islands (or mainlands) when individual islands were colonised and abandoned. This could be done only for islands that have good occupation data, and therefore, by necessity, conclusions are based on a set level of observation. As discussed in Chapter 7, there are no obvious similarities in the occupation histories between the islands in the case studies when viewed together; however, combinations of distance, size, resources, and different degrees of interaction had a number of effects. Some observations on these effects were made when looking at the islands in specific combinations and were synthesised in the previous chapter, but it is worth emphasising a few points here.

On a general level, with regard to settlement, the fact that islands settled earlier (6^{th}-4^{th} mill cal BC) experienced initial occupation periods that on average lasted longer than those colonised later (3^{rd}-2^{nd} mill cal BC) (i.e. islands settled later were often abandoned sooner) may have to do with why they were settled in the first place. Rockman and Steele (2003: xx) have claimed that 'colonization underlies every subsequent occupation' and in this respect it is tempting to connect the temporal pattern noted above with the fact that some islands may have been colonised for farming and others for trade. However, this explanation is not fully satisfying as it relies on viewing the former as a more permanent activity or less prone to fluctuations than the latter. On the other hand, the pattern may be a distant reflection of changes in the socio-political environment that partly escape us. The introduction of sail technology at the end of the 3^{rd} millennium cal. BC (in the Aegean - later in the western Mediterranean) is more than likely to have played a prominent role in this, as in general it made moving between islands and mainlands a much more viable option than before, when transport relied solely on canoes, but it also offered a buffer against community vulnerability and opened up further opportunities for development.

Moving on to more specific causes, distinct phases of instability on Kythera, Naxos, Melos, and Kea were likely to be related to political factors operating on the Greek mainland. However, these events affected them differently, regardless of the timing of initial human occupation, which took place approximately at the same time, towards the end of the 5^{th}/beginning of the 4^{th} millennium cal. BC. Differences in the islands' sizes (Naxos being the largest), distance to the mainland (Kea and Kythera being the closest), and availability of resources (Melos being a primary source of obsidian) affected the inhabitants' responses to these events (as discussed in Chapter 7). Of these islands, only Naxos was inhabited continuously (although there were adaptations in its settlement record), and the most convincing (and parsimonious) explanation for this is its large size and availability of resources.

Looking beyond the Aegean basin, there are other islands, such as Lipari and Mallorca, which display trajectories comparable to that of Naxos once colonised. These islands, which can be assigned to Broodbank's category of 'super-attractors' (1999a: 27), provided a focus for long-term human presence, while occupation often dwindled on islands nearby. Indeed, islands with lower biogeographical appeal were often not permanently occupied if there were nearby islands with higher ranking (e.g. Ibiza and Mallorca, Salina and Lipari). This tendency reinforces the idea that humans ascribe a relative value to geographical variables, as, had Ibiza and Salina stood either alone or next only to smaller islands, they might have been perceived as 'super-attractors' worth investment in their own right. Instead, while on average the islands in the case studies were occupied for periods lasting more than twice as long the time they were abandoned, abandonment lasted as long as, and sometimes longer than, occupation periods on islands close to super-attractors (e.g. Naxos), and generally on all small islands, unless specific resources were present (note the similarities in the obsidian islands' occupational history [Chapter 7]).

Although it may be impossible to reconstruct the exact conditions which led to colonisation and abandonment processes unfolding in prehistory as they did, this study has put forward a number of hypotheses. A fruitful avenue of enquiry for the future would be to shift as much as possible the emphasis from the islands to the people and to attempt to 'map the worldview of the islanders' (Renfrew 2004: 287). Pitching correctly the scale of enquiry for gauging the islanders' worldview is no easy task. In the context of the Cyclades, Broodbank (2000: 110) has explained that networks rather than individual island communities were more important to the long-term continuity of island life. 'Networks install a series of two-way relations, so that both newly occupied areas and homelands should bear the marks of this interaction' (Gosden 1993: 24). The extent of this interaction can be measured physically at any given point, for example by mapping locations of settlement sites and of resources in use contemporaneously; however, networks did not stay fixed over time. Changes in maritime technology were crucial: distances would have been perceived differently depending on whether canoes or sailing vessels were available, as days of travel could be reduced accordingly. In turn, distance (in terms of time of travel) may have had an effect on the value ascribed to resources (with hard-to-get resources valued highly). Bradley (2000: 41) has suggested that islands that were hard to reach may have conferred special qualities on the materials that were found there, which in effect came to be regarded as 'pieces of places' (Bradley 2000: 87, 88). As these cultural factors were fed back into the networks, the nature of interaction also changed.

Cultural connotations are likely to have affected the way that distance, contact, and the acquisition of resources and knowledge were perceived (Helms 1988: 4; Broodbank 2000: 94, 258; Strasser 2003). Thus, Anderson has recently stated that technological seafaring innovation should not be taken for granted or as 'a passive platform' for the transport of people and goods and, instead, that boats were 'decisive agents in the creation of insular isolation and interaction' (2004: 264) (cf. Broodbank 2000: 96). For example, Broodbank has explained that, while canoes were in use in the prehistoric Aegean, only small loads of goods could be transported, and that this would have resulted in 'a dispersed rather than centralised storage practice', the latter coming into place partly as a result of increased cargo capacity (2000: 101).

By enabling people to travel more effectively, technology placed communities closer to each other. It may be that this link or association with others (e.g. in terms of knowledge) was also an asset that was being sought, while in the case of hard-to-get-to places, access to resources may have strengthened ties between communities or triggered further competition. It is this alternating character of the sea, as a connecting and isolating element, both at the natural and cultural level, that island cultures so well illustrate (Dawson forthcoming). Thus, this study addresses the question of whether the patterns and differences in the colonisation and abandonment sequences from different islands are the result of real relationships of cause and effect, within this frame of changing values.

In conclusion, the general lack of colonisation patterning at the micro scale does not mean that geographical features did not play a relevant role in the process, as the macro-regional scale amply demonstrates (cf. parallels noted at different times in the colonisation trajectories of the Ionian and Dalmatian islands, the SW Aegean islands and the Cyclades, the Ionian and NE Aegean islands, the North African and southern Sicilian islands, and the Aeolian and Spanish islands). At the lower end of the spectrum, choices affected the decision of which islands to go to, exploit, or settle, as physical limits and resource limitations were overcome and opportunities created at different times. On a regional scale, processes such as 'autocatalysis' (Broodbank 1999a, see Chapter 3) brought on the colonisation of islands lying close to each other (e.g. the south-west Aegean, the Egadi islands, and the Ionian and Dalmatian islands). However, this was not always the case, as temporal gaps in colonisation sequences at the micro scale clearly indicate. In some cases, this may be due to lack of systematic research (as is possibly the case for the Northern Sporadhes and the Tremiti islands), or to difficulties arising from low site-visibility. However, with few exceptions, it seems to reflect some reality in the past. Choices and opportunities depended on local conditions, which are clearly responsible for some of the irregularities or 'noise' displayed in most Mediterranean island histories (Cherry 1981, 2004). For this reason, it is important that studies of islands consider the physical and cultural make-ups both of their environment (island 'units') and of their environs ('islandscapes')

The Study of Islands and Prehistory

Detailed reconstructions based on material evidence can tell us about what happened on individual islands; however, these fragments must then be reassembled in a meaningful way and located within the long-term history of the Mediterranean as a whole. A useful distinction to make is whether studies should focus on investigating history *in* the islands or *of* the islands. Horden and Purcell made this point in their study of the Mediterranean, in which they viewed history "in" as 'contingent history', which is 'not related directly to its geographical setting' (2000: 9), and history "of" as 'an understanding of the whole environment', intended as 'the interaction of human and physical factors' (ibid.). This approach finds a good parallel in recent work by Rockman, who envisages colonisation (and by extension human history) as a process of 'landscape learning', in which the acquisition of knowledge is 'a consistent process that draws on contingent situations' (2003: 12). Some generalisation (not necessarily a negative feature) is required when seeking to explain a history *of*, since contemplating the detail afforded by histories *in* is of only limited value if this is not employed in any broader analysis.

The occupational record of the islands is an essential component of the history *of* the Mediterranean. A history of islands can be achieved by focusing on elements found recurrently in their record, starting for example from those that characterise their physical make-up. The relative weight of these elements can then be gauged by comparing their histories, which are histories *in*, thus offering a scale of generalisations, or histories *of* the island, island group, island-mainland, and different Mediterranean regions. These offer a counterpoint to the palimpsest of trends that emerge from analyses of eastern vs. western Mediterranean islands, as only an awareness of processes acting at smaller scales can justify the use of more general models.

In exploring the occupational history of the islands, this study set out to investigate when islands, and which islands, were colonised and abandoned in Mediterranean prehistory as well as why. It investigated configuration (i.e. do geometrical properties lead to parallel trajectories?), resources (i.e. do islands with resources share similar colonisation histories?), time (i.e. can we distinguish between Palaeolithic, Mesolithic, Neolithic, Bronze and Iron Age colonisation/abandonment?), and finally activity (i.e. what do the material remains tell us about variations in human action?). Considering the difficulties with relating types of material found on islands to activities, it would seem more viable to study human-island interaction by period or geographical area, which is by and large how colonisation has been approached in the past (while, as mentioned, abandonment has rarely entered the picture). However, in the first case, increasingly fine chronological resolution is necessary if synchronisation between processes is to be demonstrated rather than assumed, and specific models have to be developed for colonisation and abandonment in those periods. In the second case, spatial models have to be fine-tuned, by taking configuration differences into account, and cultural variables need to be factored in.

Addressing interaction by 'type' has the benefit that activities can be explored through time and space, making the most of the previous two approaches. Obviously, a balance must be achieved between speculation and useful comparison. In that respect, studying colonisation and abandonment activities by type is a valid avenue for investigation as long as the right weight is given to the temporal context of cultural development, lest we place the islands 'out of time' (Renfrew 1978b, 2004). This 'time' includes both the prehistoric context of what is being compared and the present context of academic discourse, as this is likely to influence the conditions surrounding the comparison and its outcome.

Previous studies of colonisation have sought to provide a touchstone for identifying different activities in the archaeological record. This has remained elusive, as its search has relied traditionally on a teleological view of colonisation and abandonment (treating activities on islands as largely geared towards their permanent settlement), which could at best accommodate a rigid relationship between archaeological correlates and past human activities. Rather than producing a list unlikely to survive a single year of fieldwork, hypotheses have been made in this study as to which correlates can be taken as diagnostic of different types of colonisation and abandonment activities in a variety of geographical and temporal contexts.

Interaction emerged from this study as a key issue; however, its understanding is made more complex by the fact that contact took place within settings that changed over time. 'Islands, and especially island clusters,... are commonly places that amplify and polarize isolation and interaction (Braudel 1972: 150)' (Broodbank 1993: 316). Nonetheless, it may prove over-reductive to explain colonisation and abandonment issues through this dialectic and, for that matter, most complex issues as simple dichotomies (cf. Gould 1987: 8; Papadopoulos 2003: 30; Anderson 2004: 255). In the Mediterranean, isolation was never a prominent factor (social isolation is also rare and, as we have seen, its effects are highly noticeable when it occurs). While interaction may have been the 'norm', it is an all-encompassing term whose components require detailed analysis. Before and during the Neolithic, links between different parts of the Mediterranean are present, but not always obvious, as they involved assumed symmetrical relationships of interaction (e.g. exchanging obsidian for perishable goods); from the Bronze Age onwards, partnerships of interaction become increasingly clear as social differences became sharper. The 'pull' (Anthony 1997) or allure of potential alternatives became more marked in the Bronze and Iron Ages, and changes in technology made it easier to pursue these alternatives further, while increased knowledge of such possibilities lowered the 'threshold of resistance' to 'push' factors at home (such as population pressure, disease, social inequality, and so on) encouraging people to move (Rockman 2003: 9). Thus, when thinking of abandonment, it is worth remembering that the pull of the mainland may be responsible for why people leave islands. 'There is always a mainland' (Renfrew 2004: 283), as human perception and sense of scale tend to scan and identify 'mainlands', be they real or another large island.

As mentioned, Mediterranean island archaeology cannot be articulated satisfactorily as a single dichotomy (e.g. 'peer-polity' vs. 'core/periphery' interaction), as the entities involved are unlikely to have remained fixed over time. Renfrew's explanation of culture change in islands (2004) and Broodbank's mechanisms for explaining initial colonisation (1999a) (see Chapter 3) share a common concern for understanding the '*topology* of isolation and interrelatedness'

(Terrell 2004: 219, emphasis in original), as well as their tempo, i.e. not just where, but also when, how, and why do islanders become isolated or engaged in networks of interaction.

In previous chapters, the roles of configuration and resources were analysed as viable avenues for investigating networks of interaction and potential causes for the abandonment of islands. From the Bronze Age onwards, it is possible to follow the movement of traded objects across established routes (for the Neolithic there are few indicators apart from obsidian, and for earlier periods this task is even harder). While the Mediterranean physical environment had by and large settled down at the time when islands became stably occupied, the social environment was in a state of flux.

The study of islands has much to offer to non-island archaeologists and vice versa. Although it was not the principal aim of this study, the islands analysed in this thesis also provided a setting in which to address a series of questions that are broadly relevant to studies of the past, such as ecology, mobility, and migration. As stated in the introduction, islands can be used as laboratories for testing theories and hypotheses on a localised scale. At the same time, it is the study of islands in their multiple combinations that sheds light most effectively on these processes. For example, this study explored differences in the nature and extent of human-environmental interaction in relation to settlement and abandonment in different spatial and temporal settings. The 'island angle' adopted in this research brought out a more nuanced understanding of such general processes and used this in turn in order to clarify different phases in the development of island communities over time.

Final Considerations

This study has sought to move beyond the east-west divide inherent in Mediterranean studies and to show the potential of bringing an island archaeological framework to the fore in Mediterranean prehistory by focusing on two inter-related processes: colonisation and abandonment. The propositions made during the course of this study are of two types. Inevitably, as further evidence becomes available, the colonisation and abandonment patterns observed on the basis of the archaeological data will change at least in part. As more fieldwork eventually substantiates or negates previous finds, the observations made here will come under close scrutiny, in the same way as previous studies were examined in this thesis. On the other hand, it is hoped that the ideas which form the nucleus on which this thesis is based will be long-lasting, as the framework expounded by this work, in terms of how colonisation and abandonment are conceptualised, is capable of incorporating instances of earlier or later colonisation and the filling of gaps in the archaeological record. In seeking to explore how the geographical and temporal data combine together, several trends have emerged, which have been related in this study to different kinds of colonisation and abandonment activities, some of which could be explored more fully than others. The study has addressed the question whether the colonisation and abandonment of islands is different from that of other landforms, and in doing so, it has endeavoured to build bridges between Mediterranean prehistory and island archaeology by asking what was the role of islands in broader prehistoric processes.

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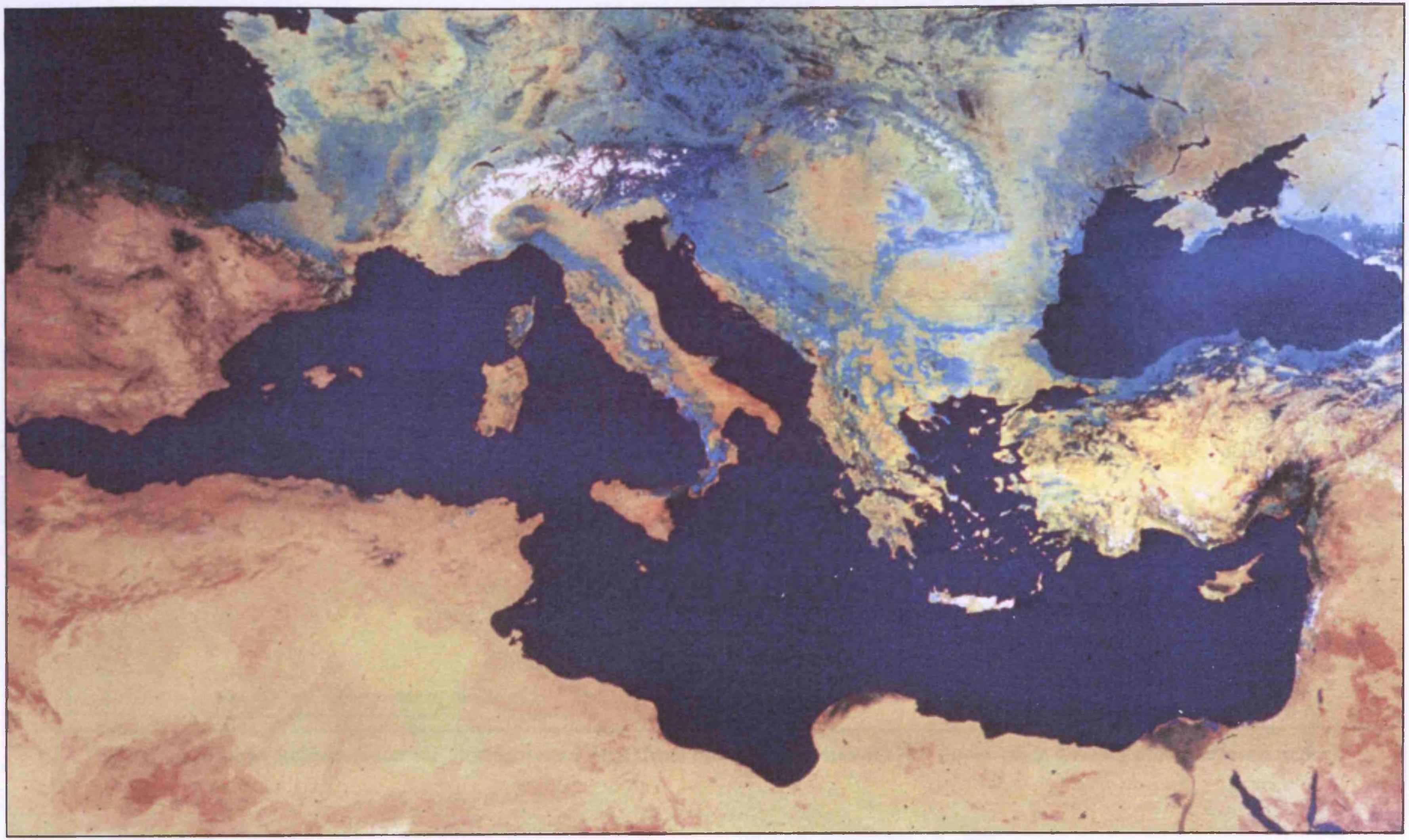


Fig. 2.1 The Mediterranean Region

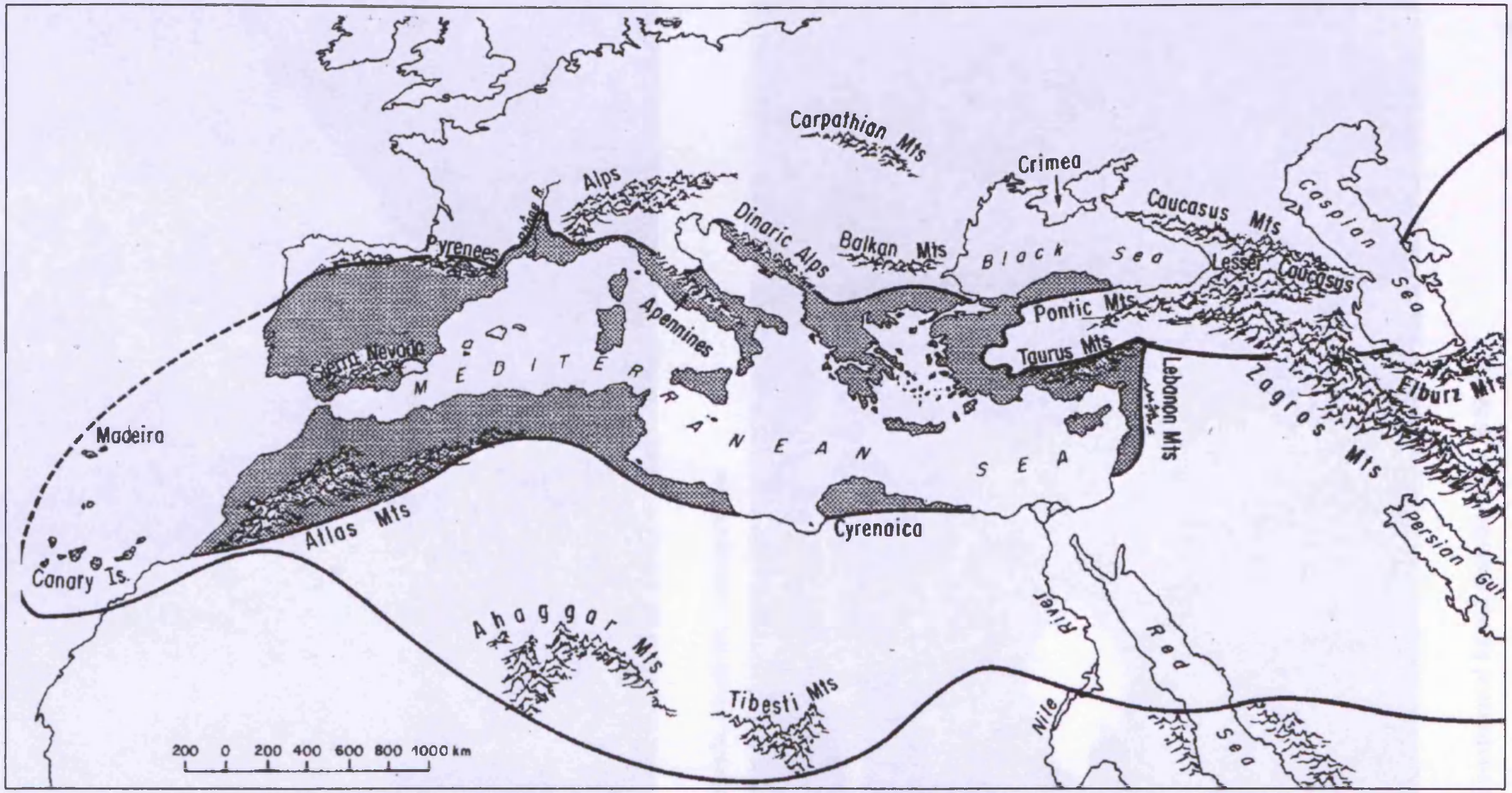


Fig. 2.2 Approximate delimitation of the Mediterranean Area (from Blondel and Aronson 1999) (lower black line indicates isoclimatic region)

Fig. 2.3. Croatian Islands, Fjord-like configuration

Fig. 2.4. Example of continental Island (Satellite view of Sicily)

Island	Alt (m)
Pianosa (Tremiti)	15
Pianosa	27
Cretaccio	30
Jerba	40
Caprara (Tremiti)	53
San Nicola	75
Giannutri	88
Palagruza	90
Vivara	109
Delos	113
San Domino	116
Lampedusa	133
Formentera	202
Ustica	244
Malta	253
Palmarola	262
Lipsoi	277
Levanzo	278
Kyra Panagia	290
Favignana	314
Leros	327
Kimolos	358
Skyros	368
Mykonos	372
Heraklia	419
Panarea	421
Lemnos	430
Zembra	432
Skiathos	433
Syros	442
Alonissos	456
Ibiza	475
Astypalaia	482
Giglio	498
Vulcano	500
Kythera	507
Aegina	532
Thera	566
Kea	568
Seriphos	585
Lipari	602
Kos	615
Montecristo	645
Alicudi	675
Siphnos	678
Kalymnos	679
Skopelos	680
Marettimo	686
Nisyros	698
Paros	706
Ios	713
Tinos	729
Melos	751
Zakynthos	756
Filicudi	774
Pantelleria	836
Corfu	914
Stromboli	924
Salina	962
Andros	994
Naxos	1000
Elba	1018
Ikaria	1037
Thasos	1070
Lefkas	1158
Rhodes	1215
Chios	1297
Samos	1433
Mallorca	1445
Samothraki	1611
Kephallonia	1628
Sardinia	1834
Cyprus	1950
Crete	2456
Corsica	2706
Sicily	3300
Average	**702**

Table 2.1. Altitude a.s.l.

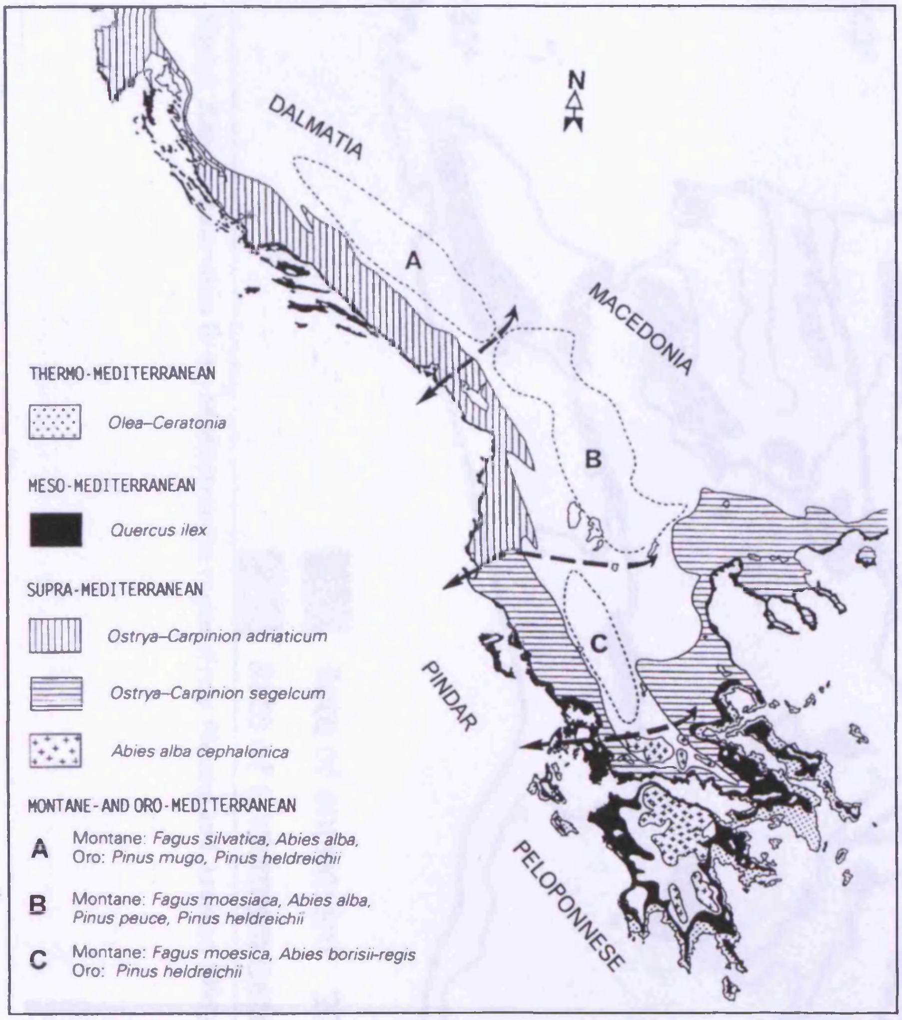


Fig. 2.5 Elevation belts (Dalmatian and Ionian Islands) (from Blondel and Aronson 1999)

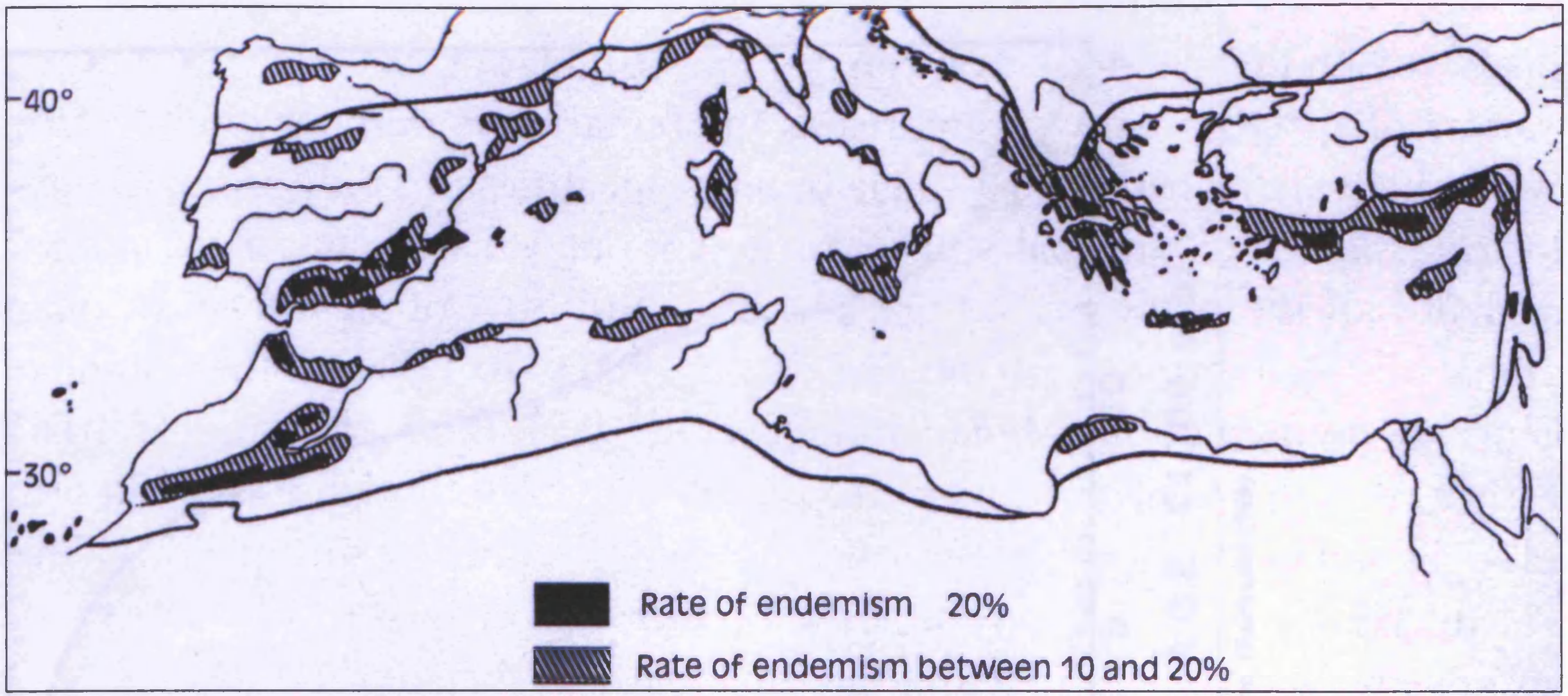


Fig.2.6. Rates of Endemism in the Mediterranean region (from Blondel and Aronson 1999)

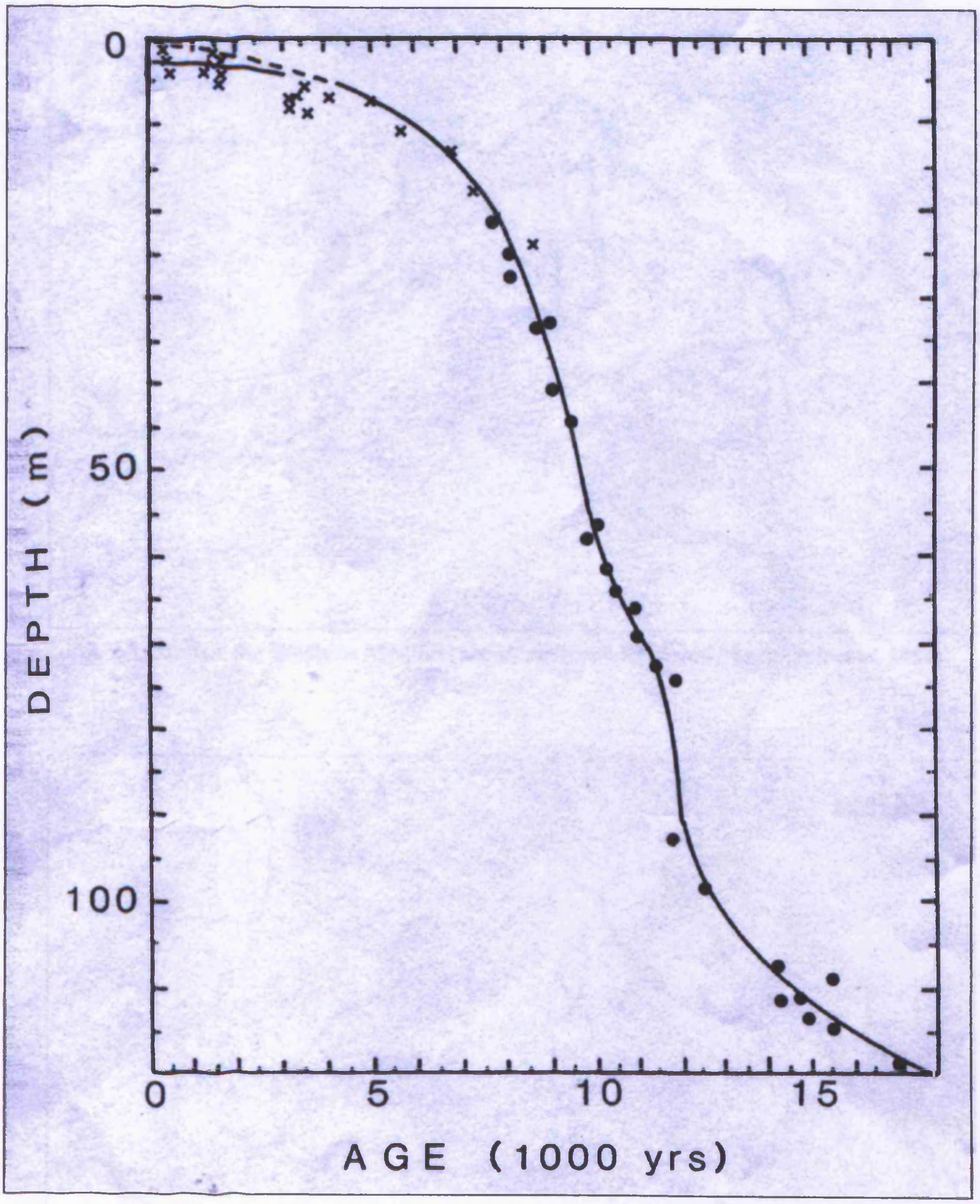


Fig. 2.7. Global Sea-level curve (Fairbanks 1989)

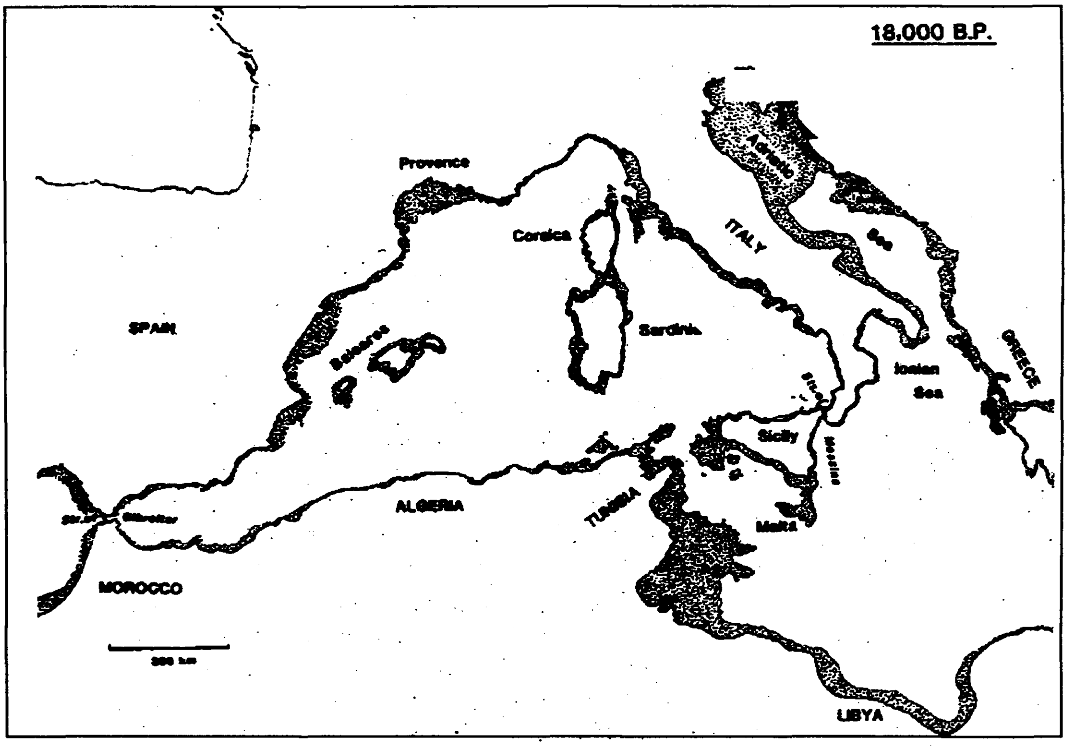


Fig. 2.8. Map of the Western Mediterranean at 18,000 BP (from Shackleton *et al.* 1984)

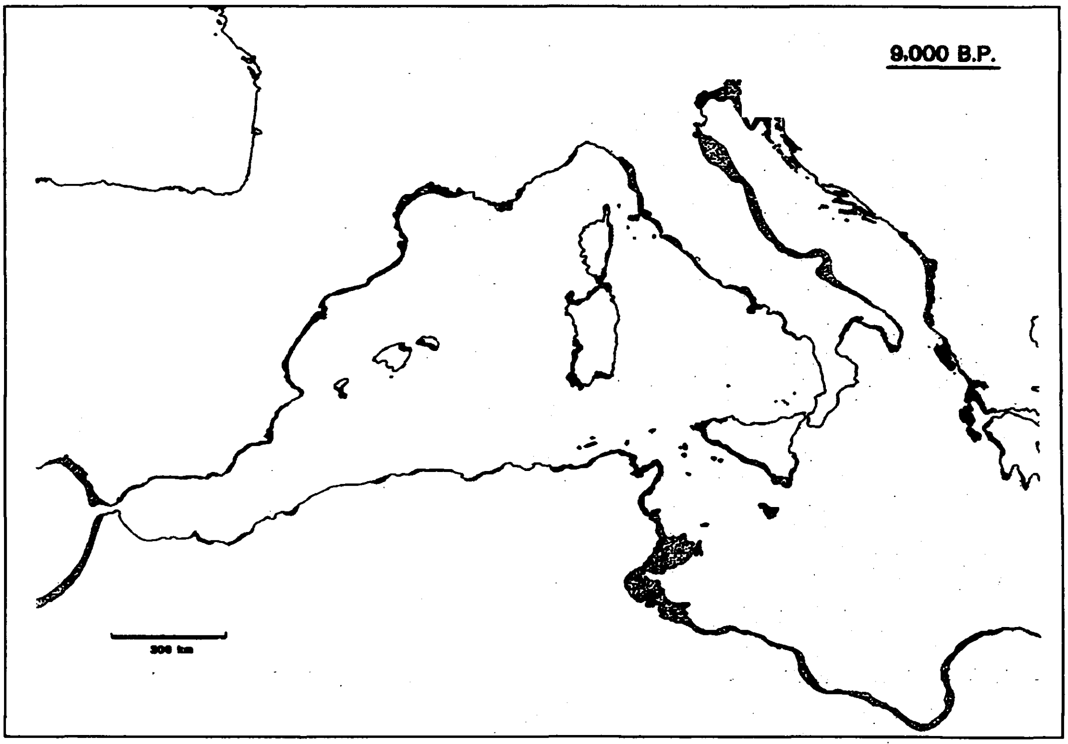


Fig. 2.9. Map of the Western Mediterranean at 9,000 BP (from Shackleton *et al.* 1984)

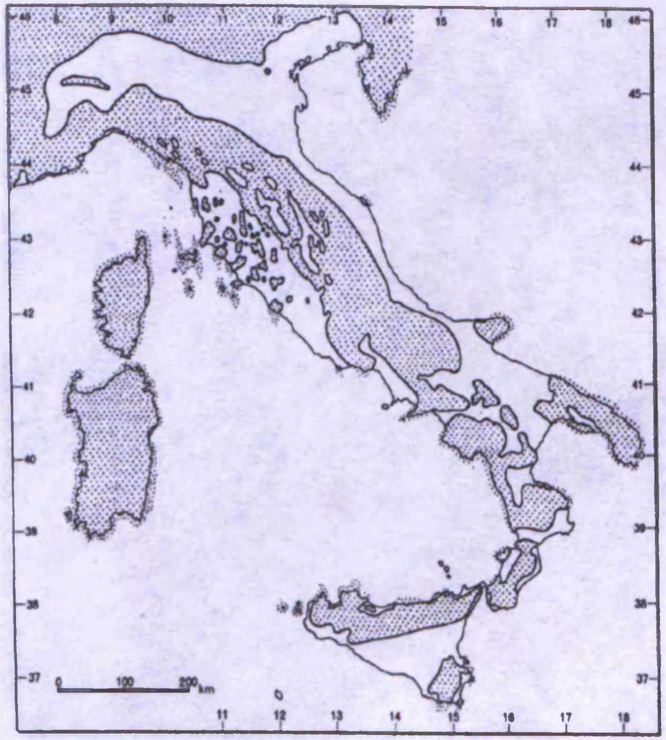


Fig. 2.10. Italy and surrounding islands in the Pliocene (Mussi 2001: 17)

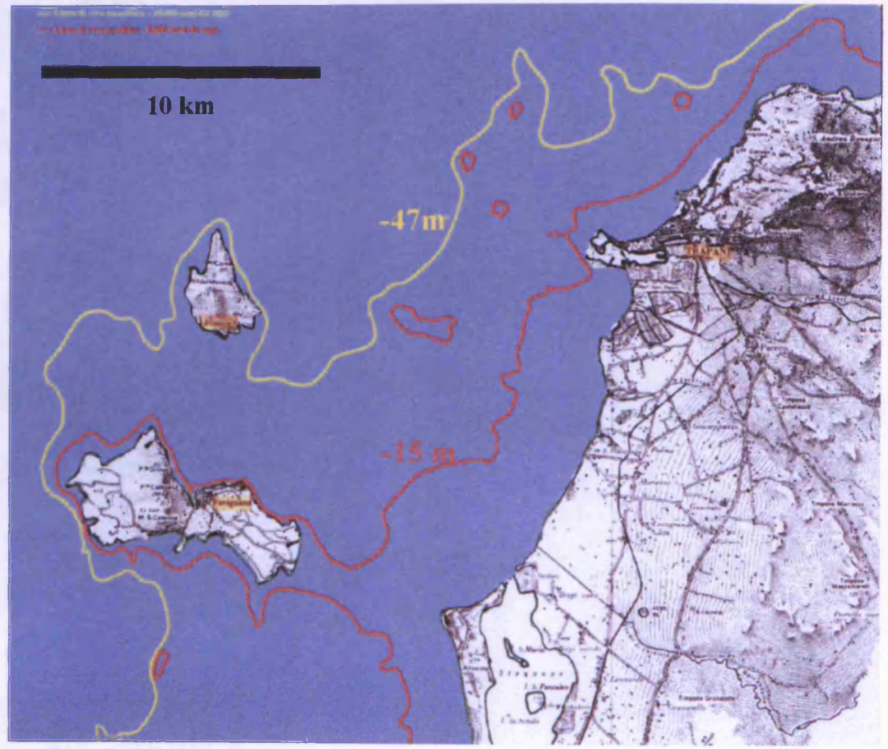


Fig. 2.11. Egadi Islands. Bathymetry (Antonioli 1997: 148)

-47 m= 10,000 BP

-15 m = 8,000 BP

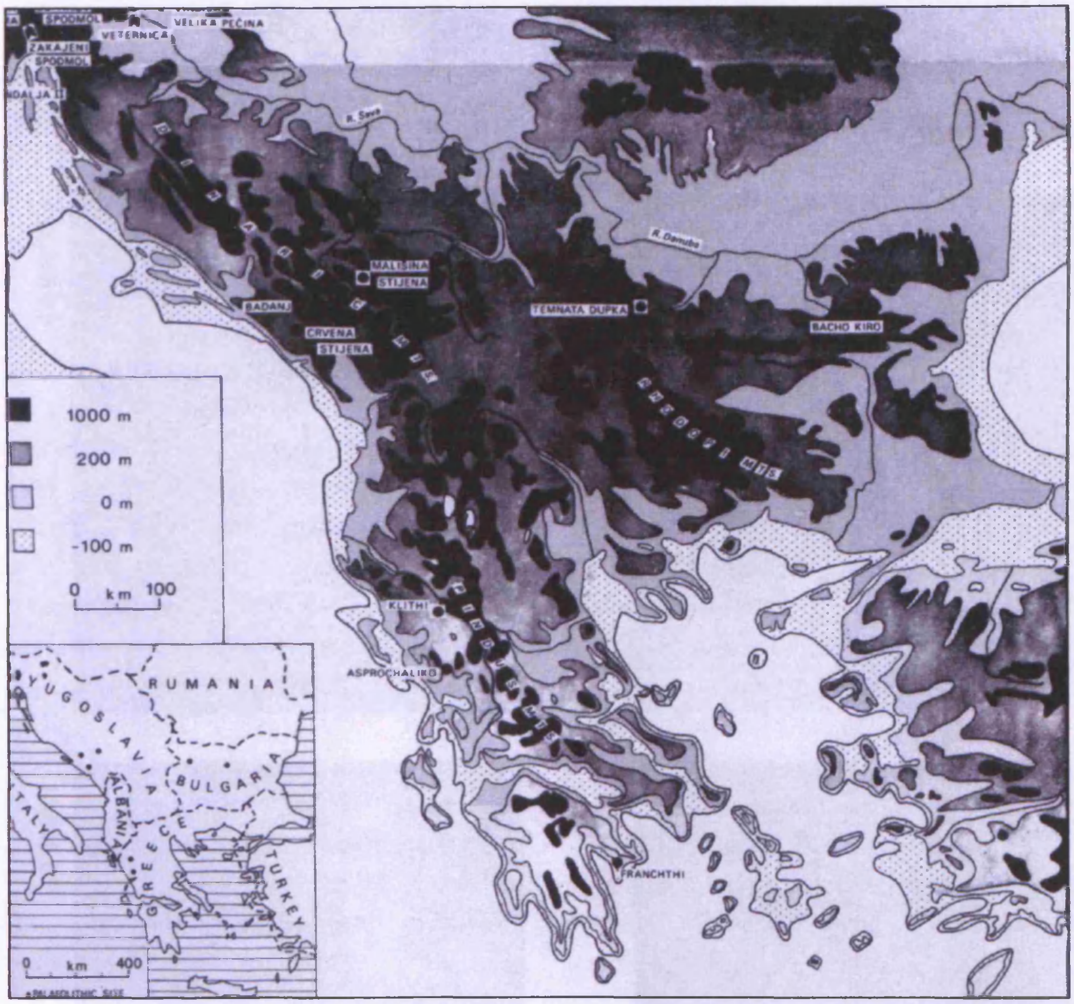


Fig. 2.12. Balkan Bathymetry (from Bailey and Gamble 1989)

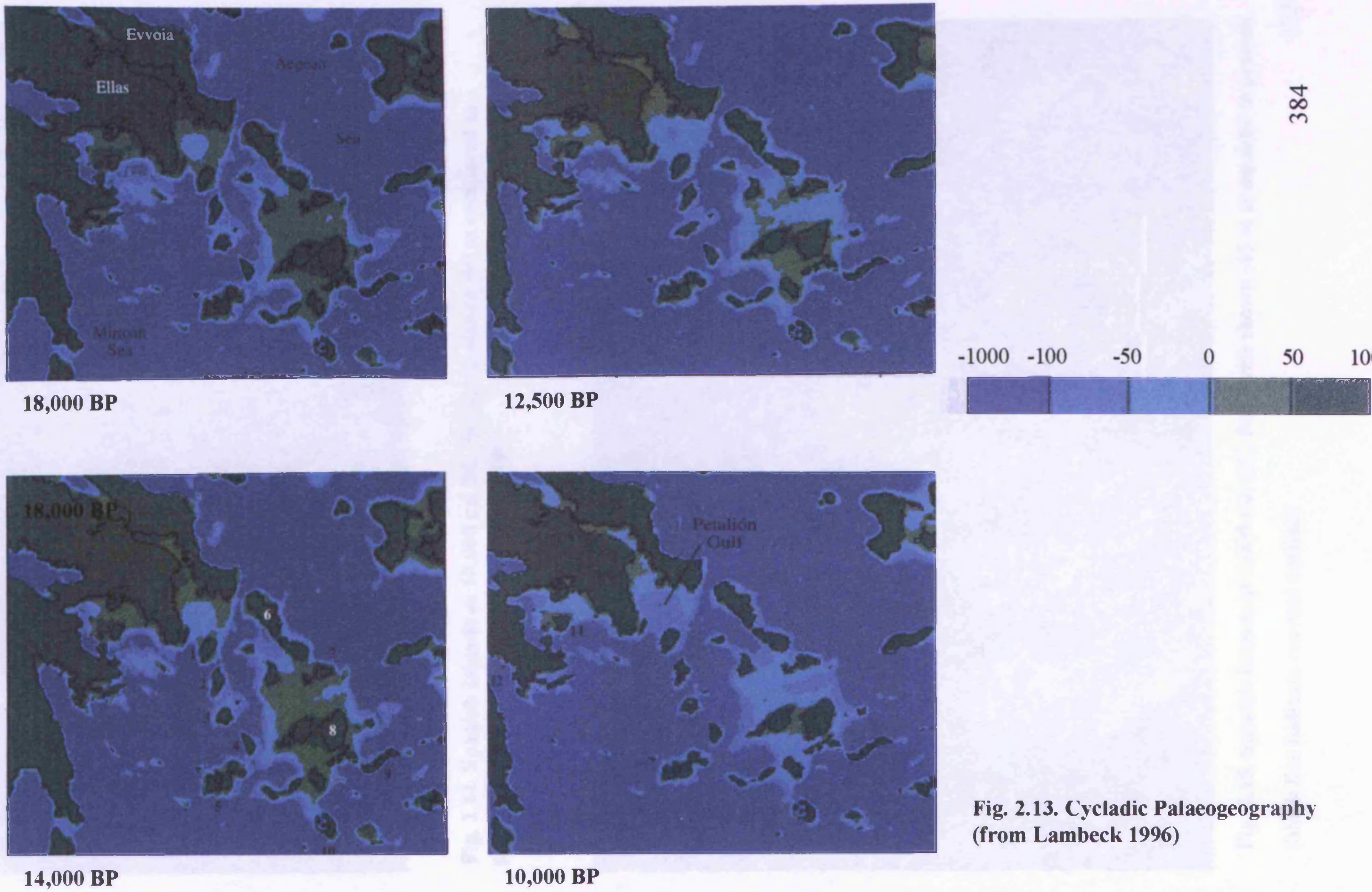


Fig. 2.13. Cycladic Palaeogeography (from Lambeck 1996)

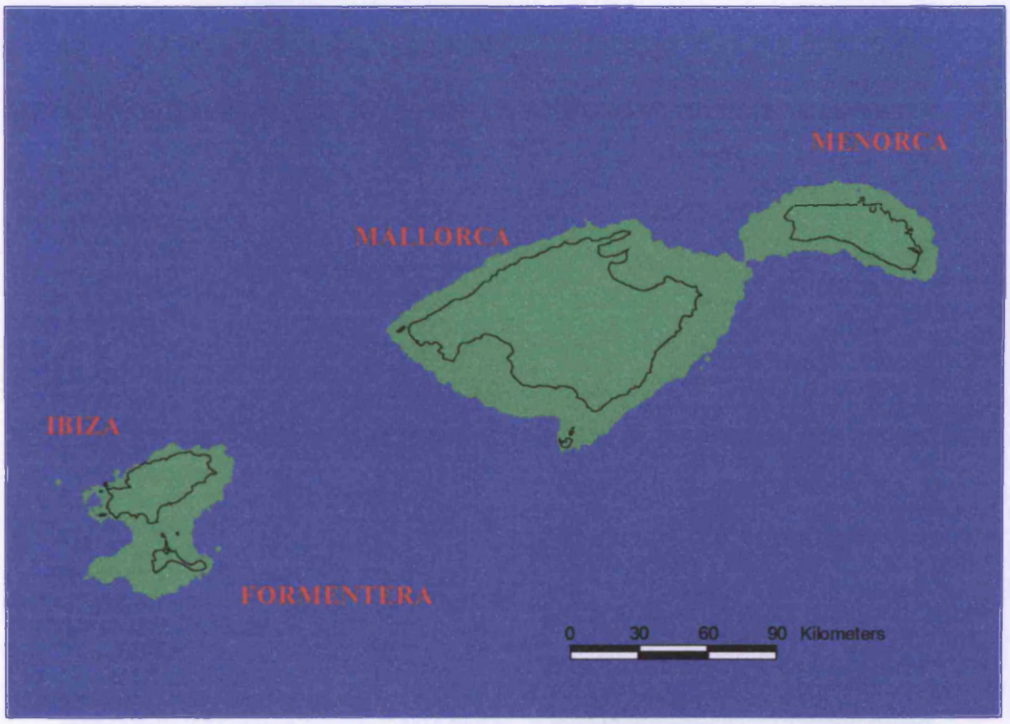


Fig. 2.14. Spanish Islands at 10,000 cal BC. Sea levels shown -90 m compared to present (black line indicates current outline)

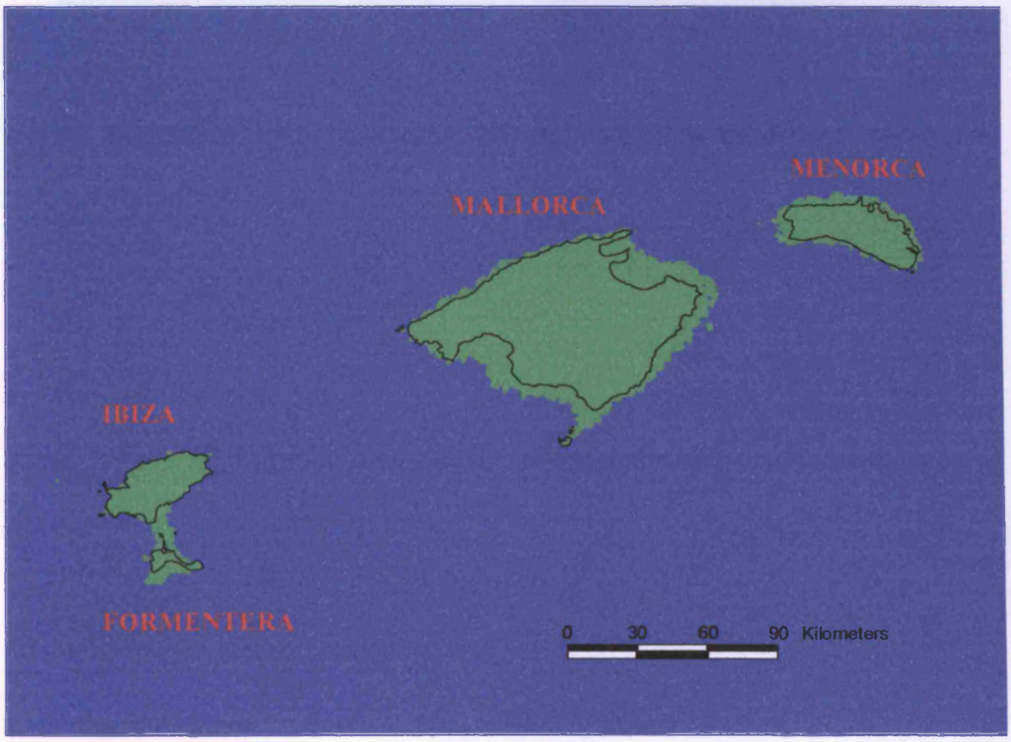


Fig. 2.15. Spanish Islands at 7,000 cal. BC. Sea levels shown -45 m compared to present (black line indicate current outline)

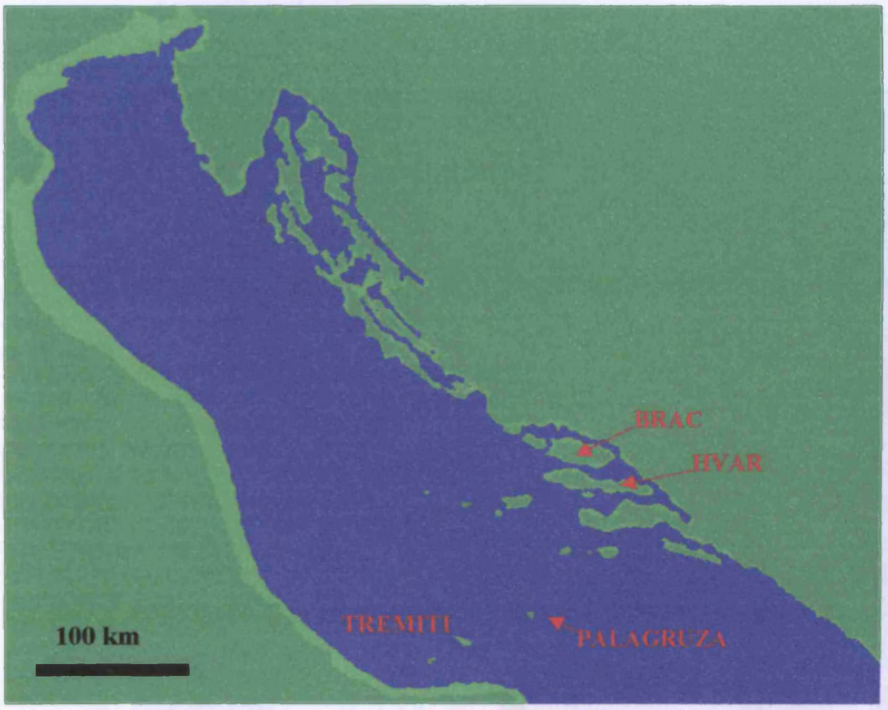


Fig. 2.16. Adriatic Islands ca. 8,000 cal BC. Sea levels shown at – 20 m compared to present (dark green indicates present outline)

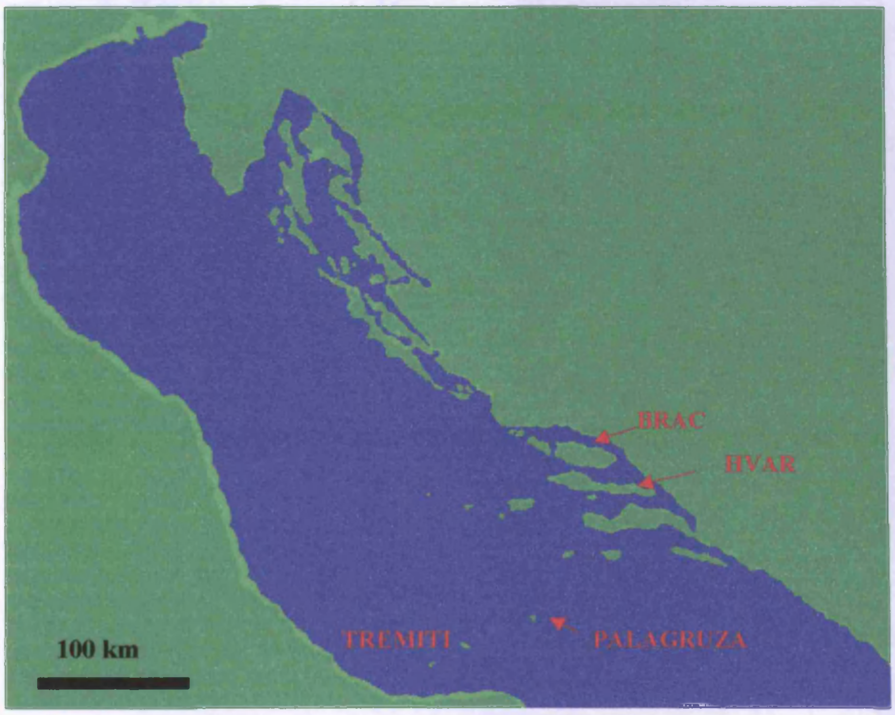


Fig. 2.17. Adriatic Islands ca. 6,000 cal BC. Sea levels shown at – 10 m compared to present (dark green indicates present outline)

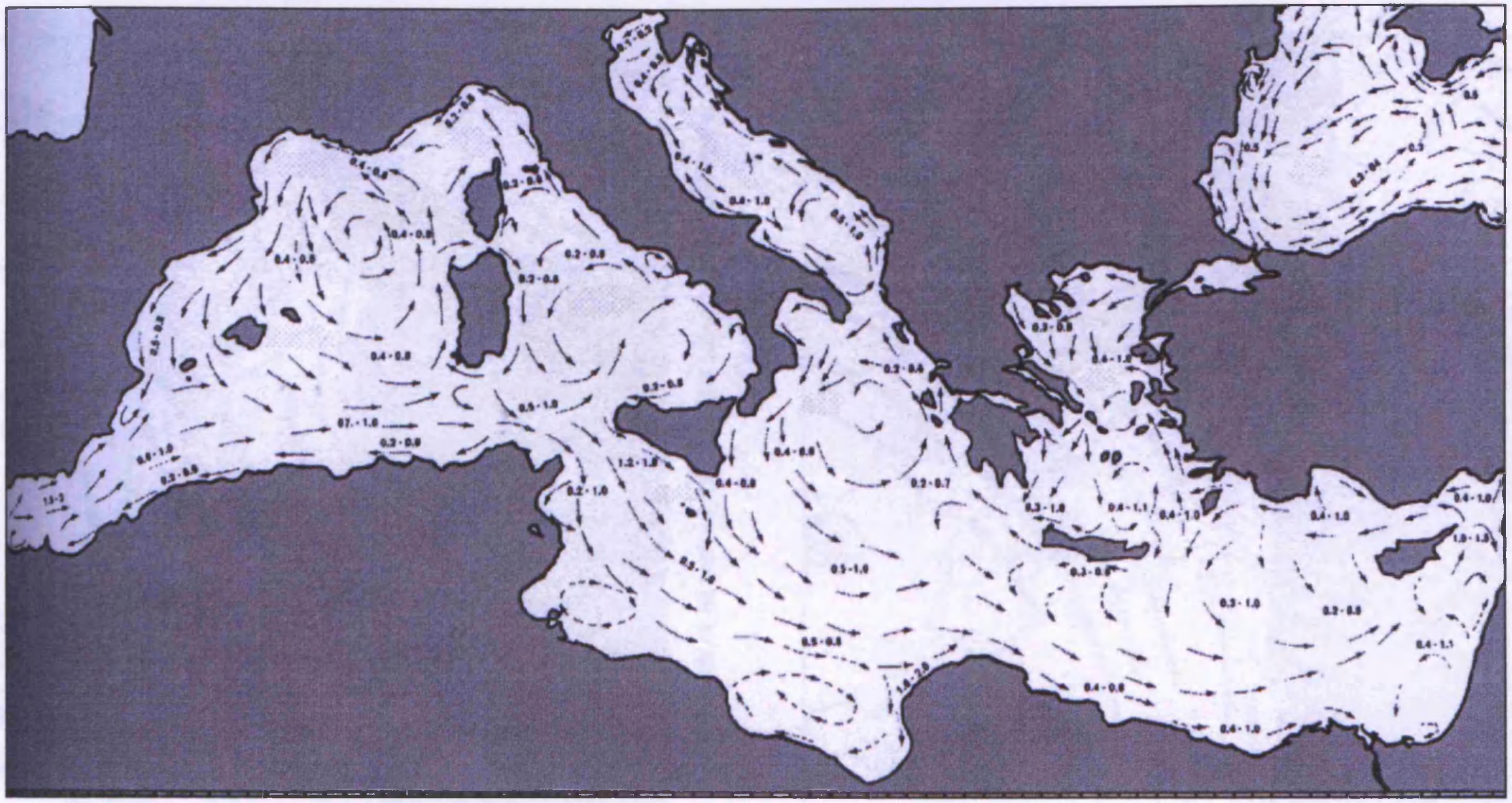


Fig. 2.18. Principal Superficial Currents in the Mediterranean (Castagnino Berlinghieri 2003)

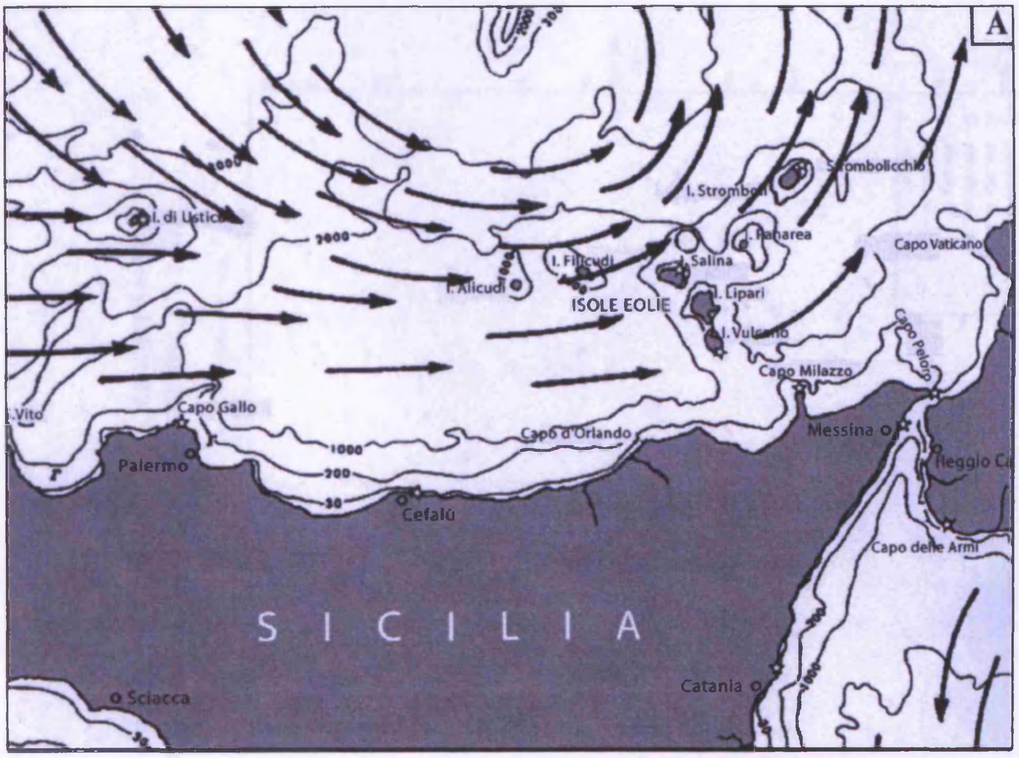


Fig. 2.19. Currents in the month of March in the Aeolian Island area (Castagnino Berlinghieri 2003: 166)

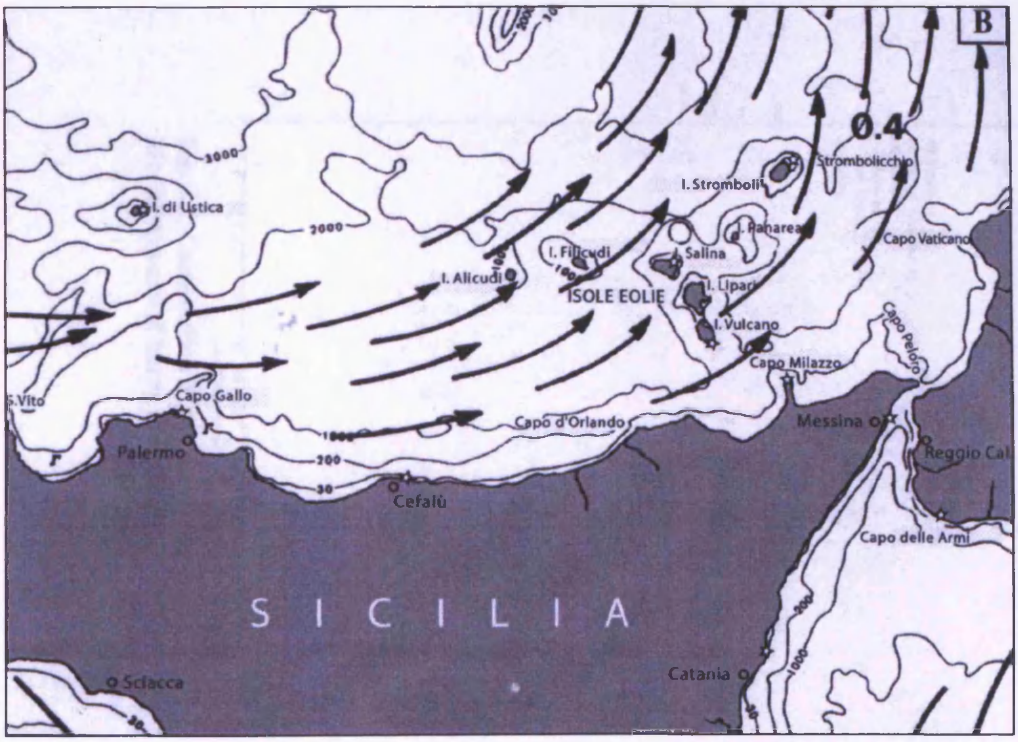


Fig. 2.20. Currents in the month of July in the Aeolian Island area (Castagnino Berlinghieri 2003: 166)

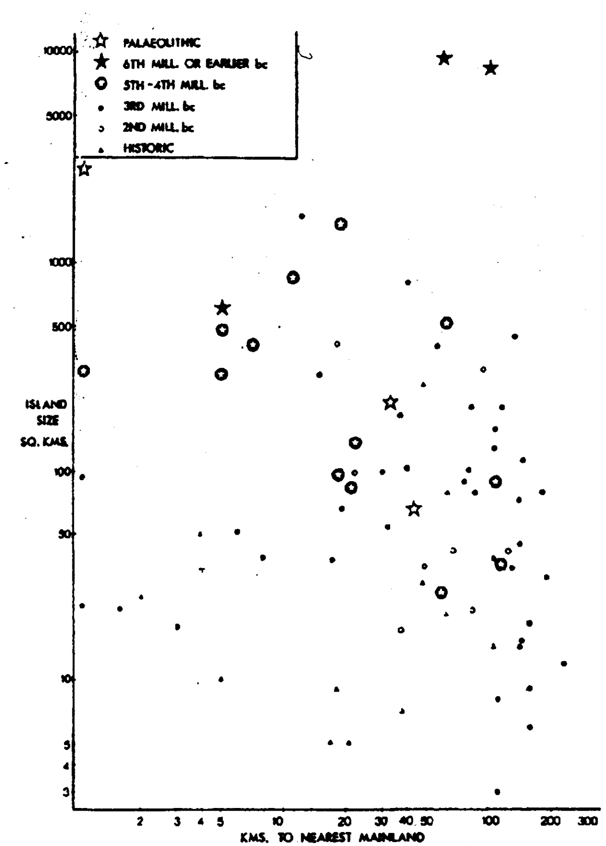


Fig. 3.1. Colonisation in the Eastern Mediterranean (Cherry 1981: 50)

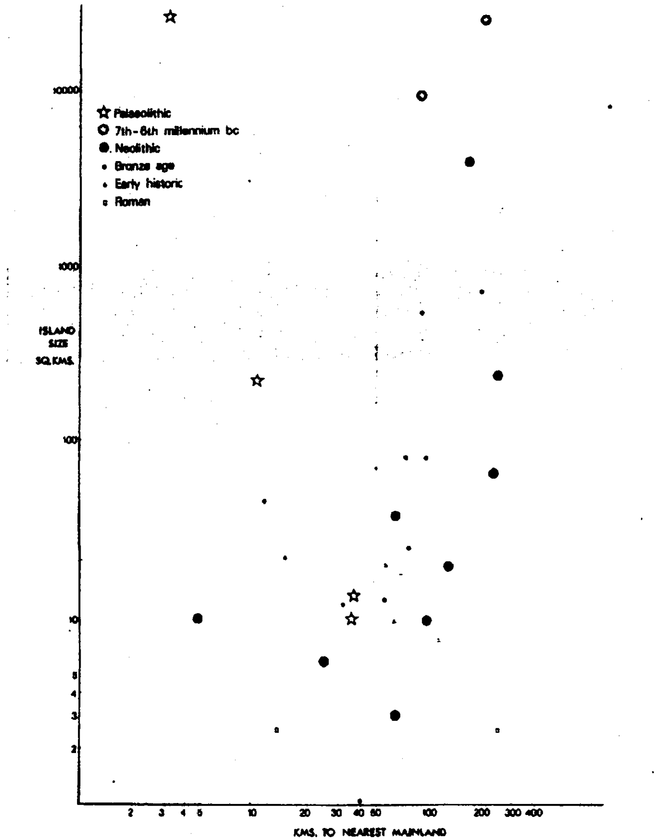


Fig. 3.2. Colonisation in the Western Mediterranean (Cherry 1981: 51)

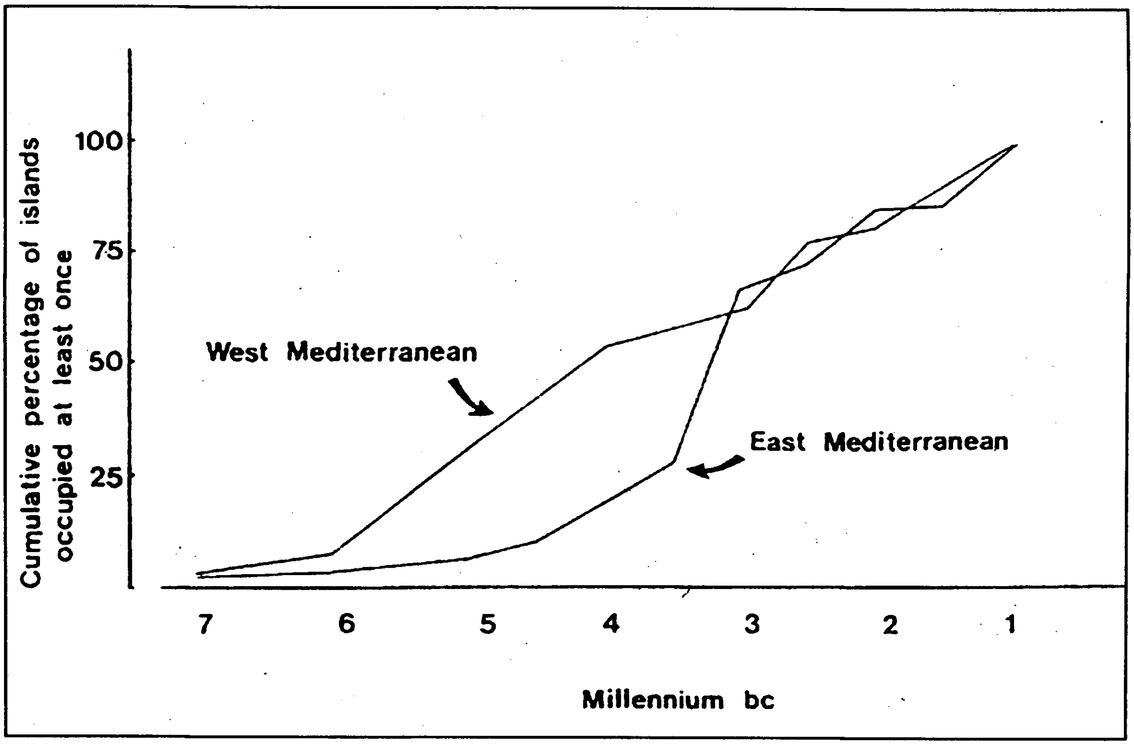


Fig. 3.3. Cumulative Plot of Island Colonisation (Cherry 1981)

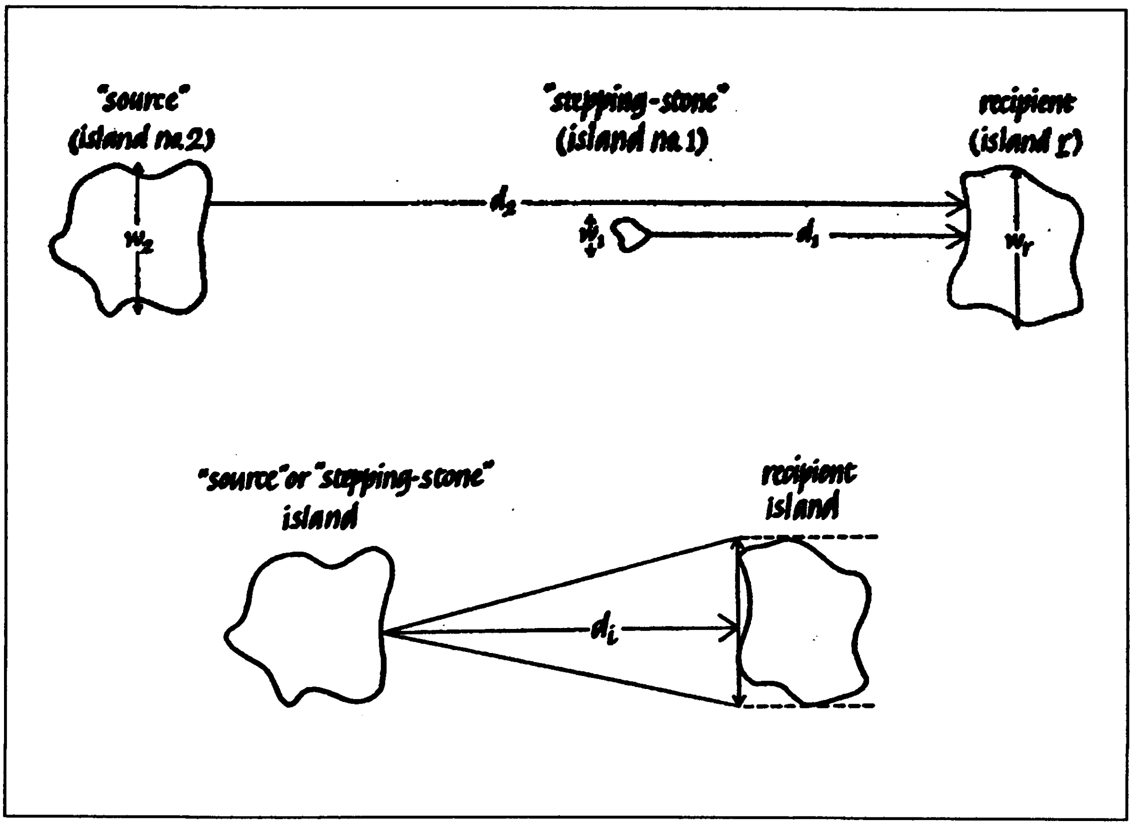


Fig. 3.4. Stepping-Stone effect (top) and Target-Distance Ratio (bottom) (from MacArthur and Wilson 1967)

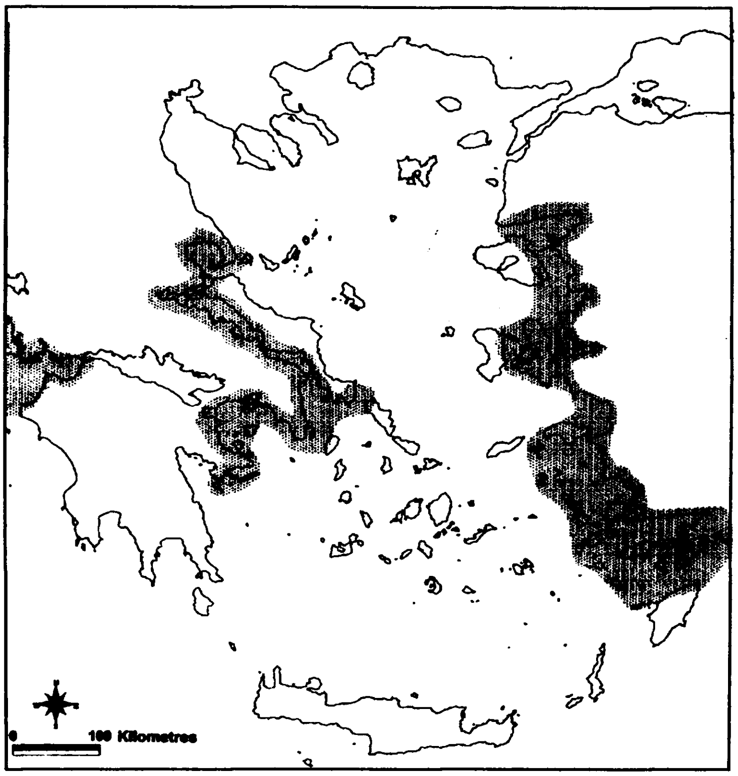


Fig. 3.5. 'Seafaring Nurseries'in the Aegean (Broodbank 1999: 26)

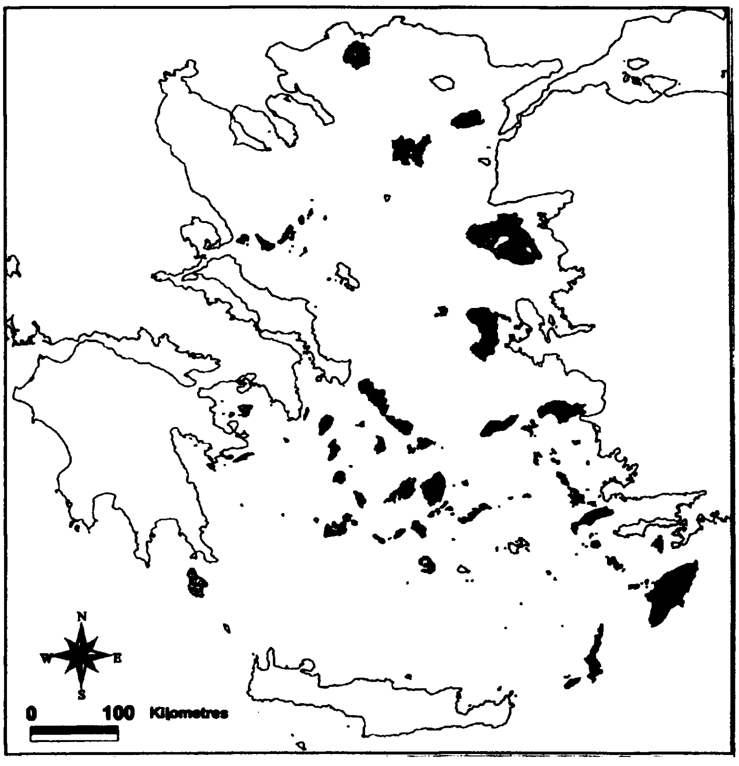


Fig. 3.6. Likely Regions for 'Autocatalysis' in the Aegean

(Broodbank 1999: 27)

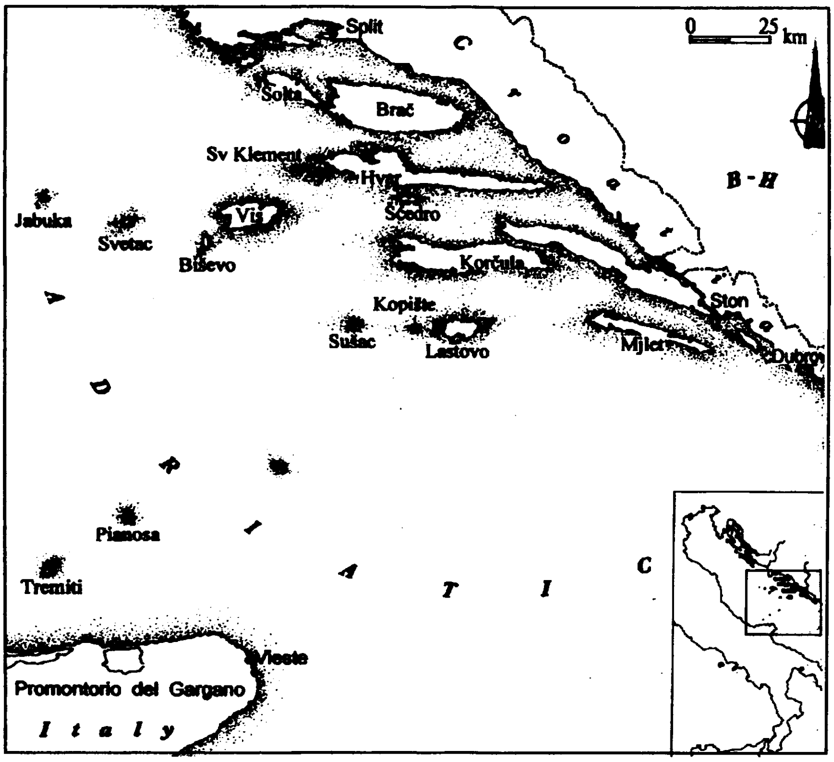


Fig. 3.7. Map of Central Adriatic Islands (Bass 1998)

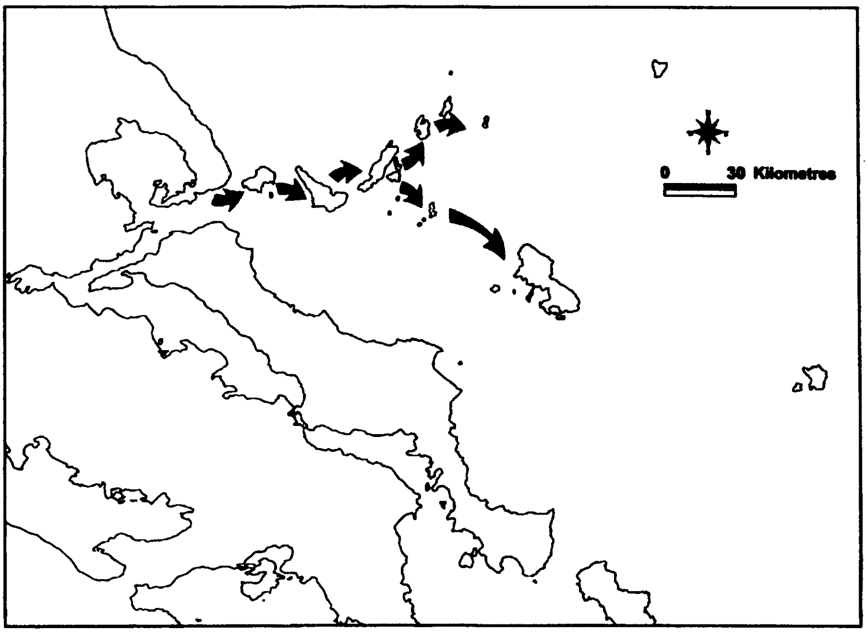


Fig. 3.8. Northern Sporadhes. Possible colonisation trajectory (Broodbank 1999: 29)

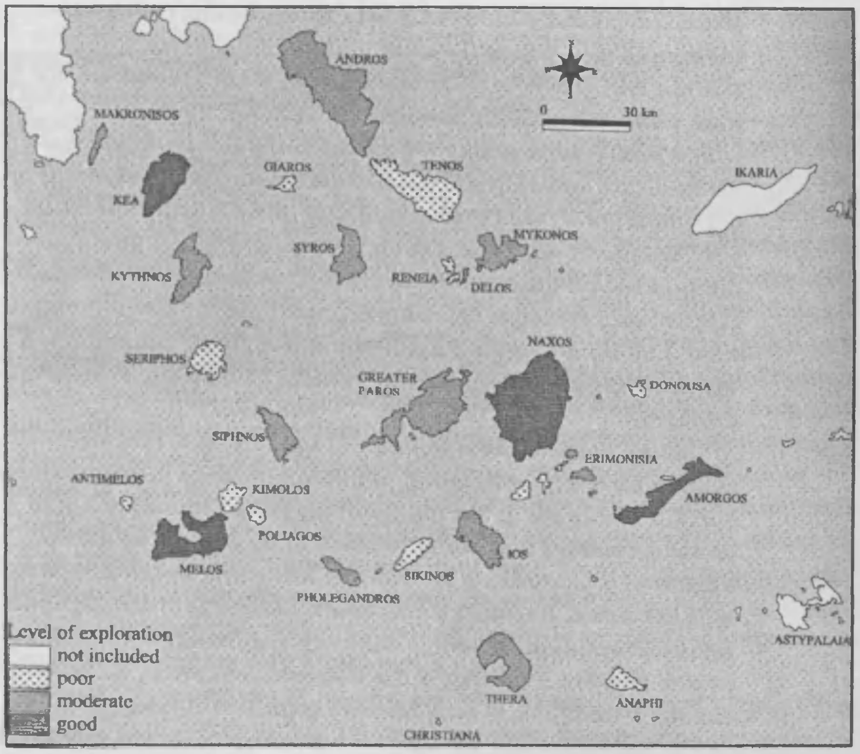
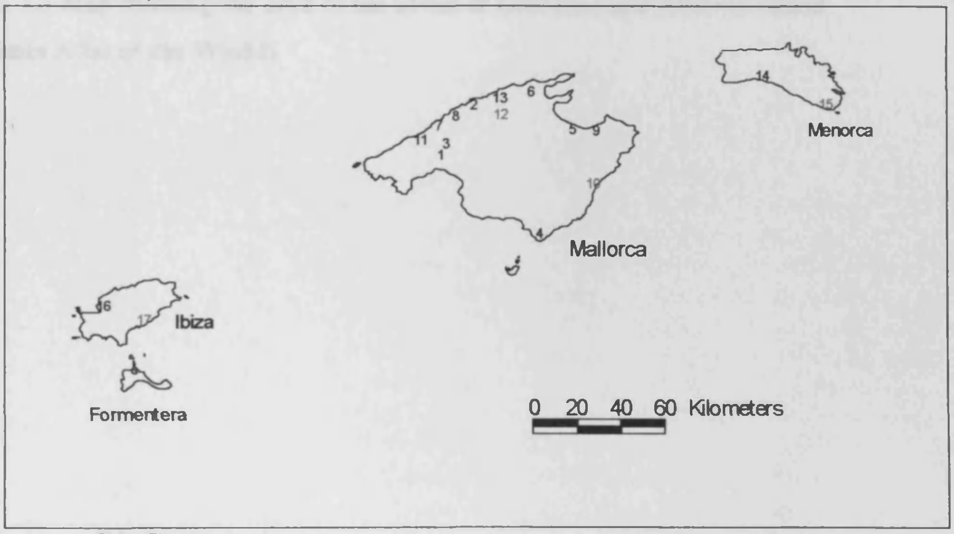


Fig. 4.1. Differential Levels of Exploration in the Cyclades (Broodbank 2000)



1.	Ca'n Canet	10.	**Cova des Moro**
2.	So'n Muleta	11.	**Son Ferrandell-Olesa**
3.	So'n Matge	12.	**Coval Simó**
4.	Flint industries (Santanyí)	13.	**Cova de Tossa Alta**
5.	Lithic workshop (So'n Real)	14.	**Cova Murada**
6.	Obsidian finds (Mortitx)	15.	**Biniai Nou**
7.	Cova de Betlem	16.	**Es Pouàs**
8.	So'n Gallard	17.	**Puig de ses Torretes**
9.	Es Caló		

Fig. 4.2. Spanish Islands with location of main sites mentioned in text (from Ramis *et al.* 2002). Most reliable sites marked in red.

Fig. 4.3 Map showing the area of the Strait of Gibraltar and Alboran Island (Times Atlas of the World)

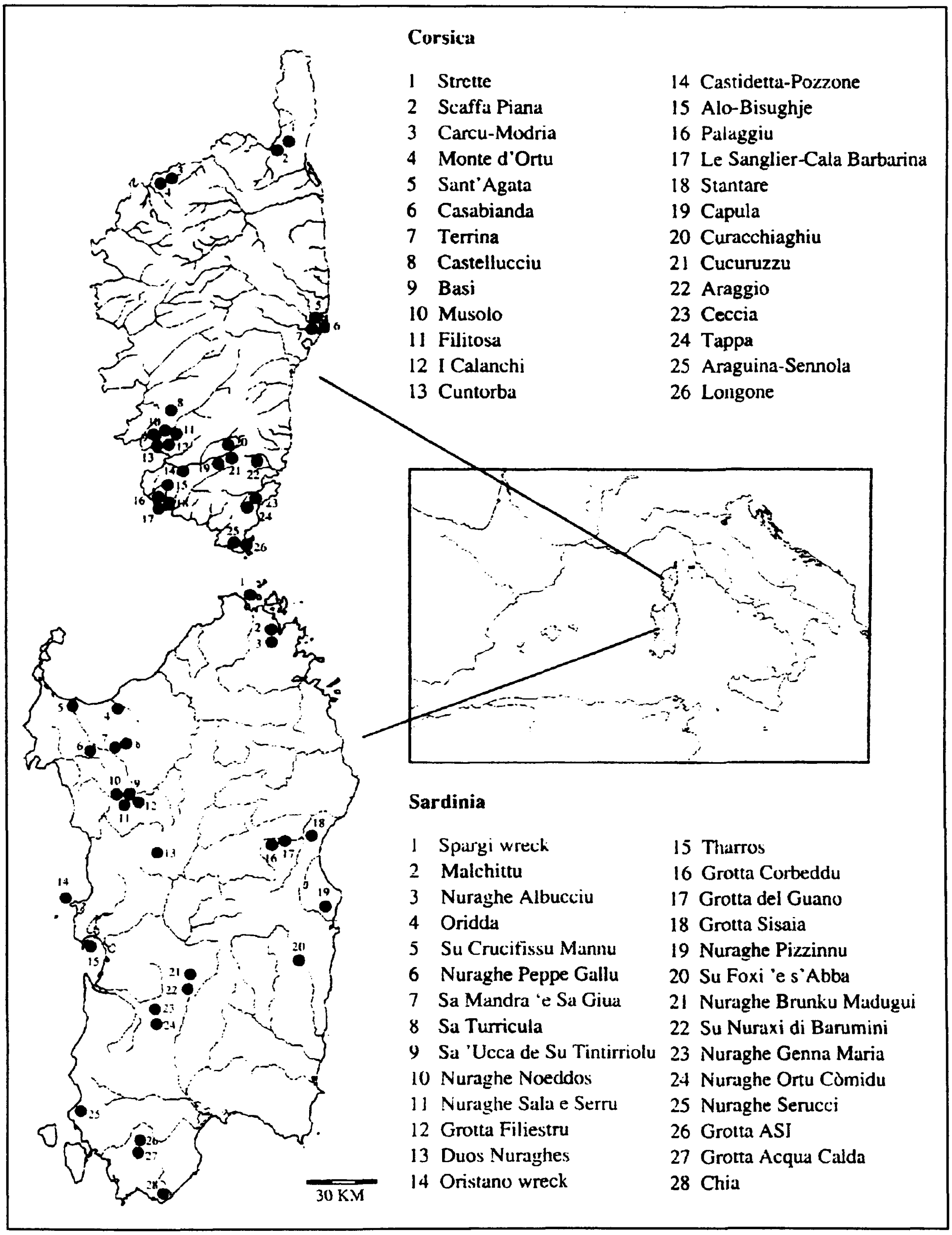


Fig. 4.4. Map of Sardinia and Corsica showing main archaeological sites (from Tykot 1994)

Fig. 4.5. Map of Central Mediterranean (from Malone 1997)

Fig. 4.6. Map of North-Central Tyrrhenian and Adriatic (from *Traveller* 2002)

Fig. 4.7. Map of Giannutri (from *Traveller* 2002)

Fig. 4.8. View of Giannutri (from *Traveller* 2002)

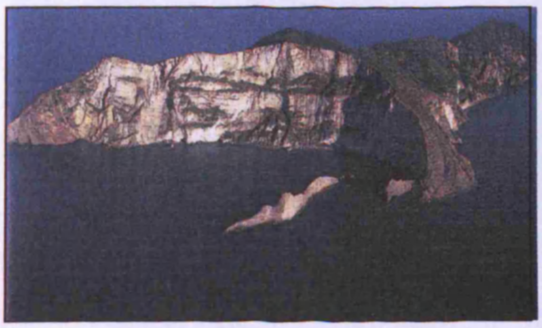


Fig. 4.9. View of Palmarola (from *Traveller* 2002)

Fig. 4.10. Map of the southern Tyrrhenian (from *Traveller* 2003)

Fig. 4.11 View of Vivara

Fig. 4.12. View of Vivara from Procida

Fig. 4.13. View of Procida and Vivara

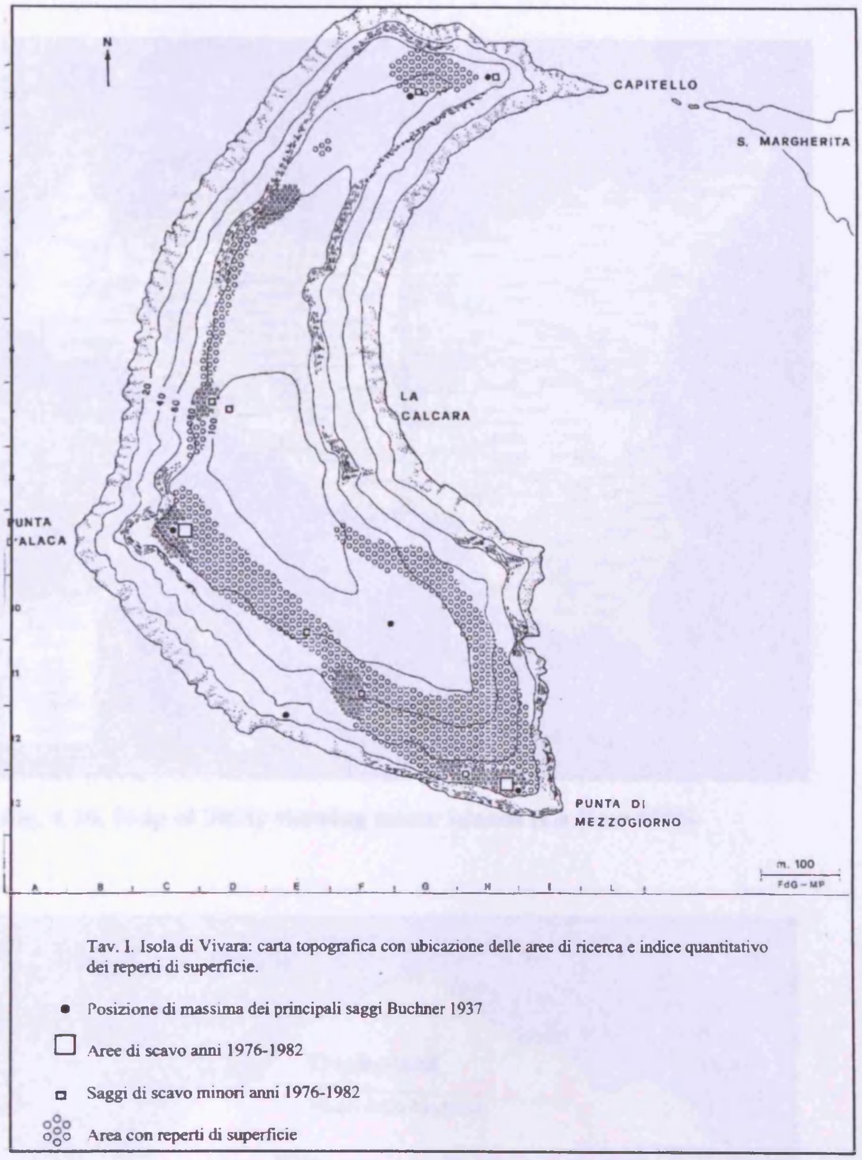


Fig. 4.14. Plan of Vivara with main archaeological sites (from Marazzi and Tusa 1994)

Fig. 4.15. View of Montecristo (from *Traveller* 2002)

Fig. 4.16. Map of Sicily showing minor islands (La Rosa 1993)

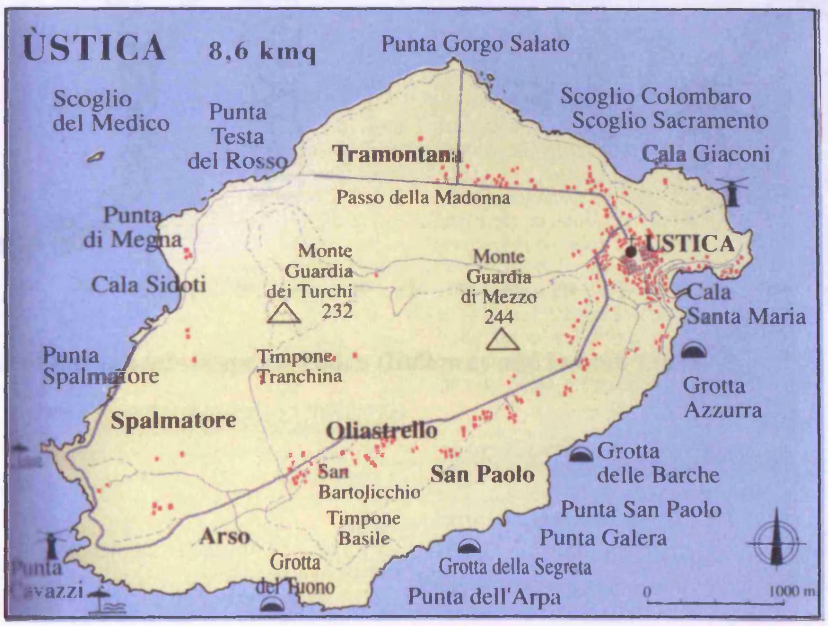


Fig. 4.17. Map of Ustica (La Rosa 1993)

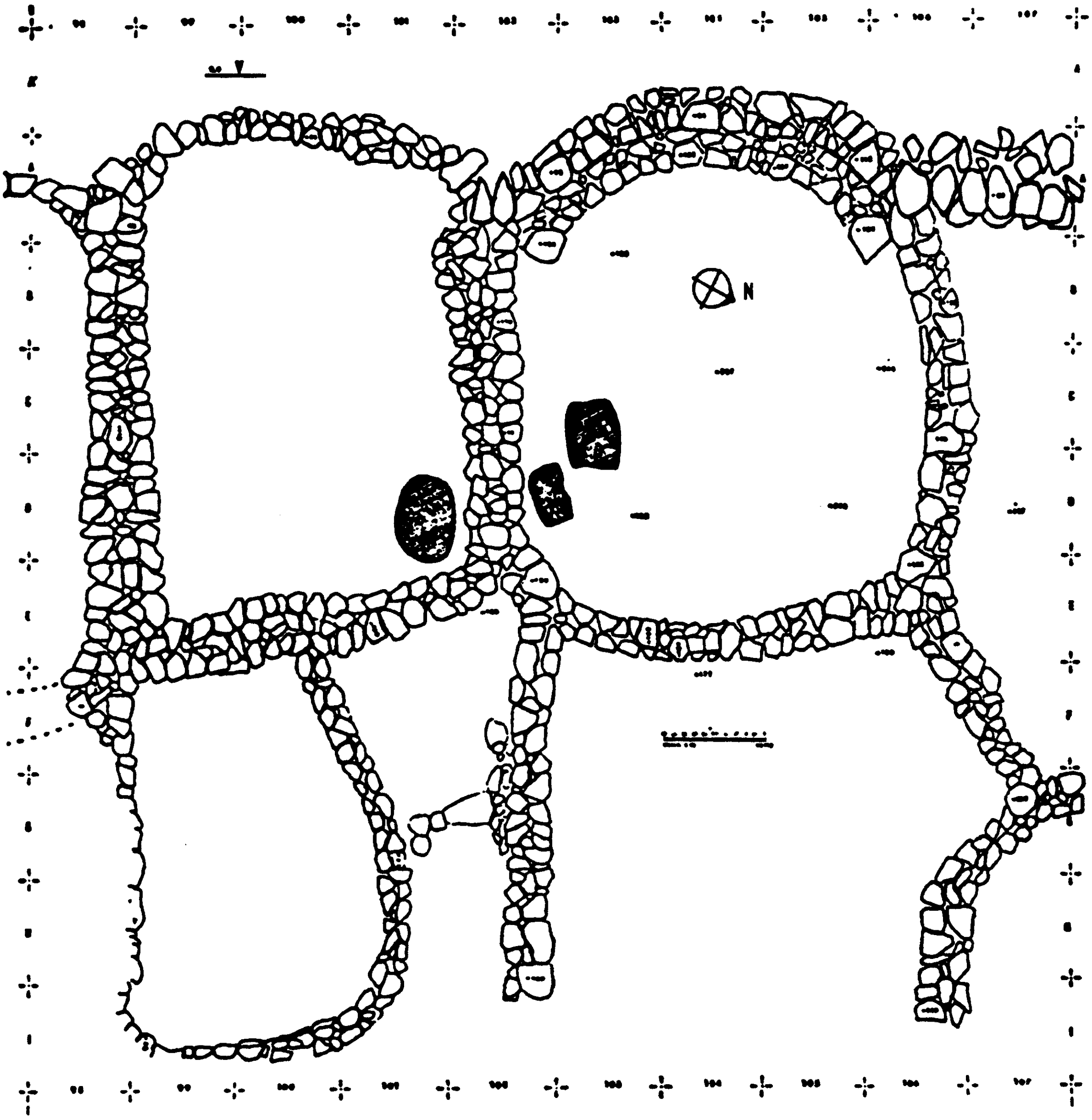


Fig. 4.18. Partial plan of Faraglioni village on Ustica (Holloway and Lukesh 1997)

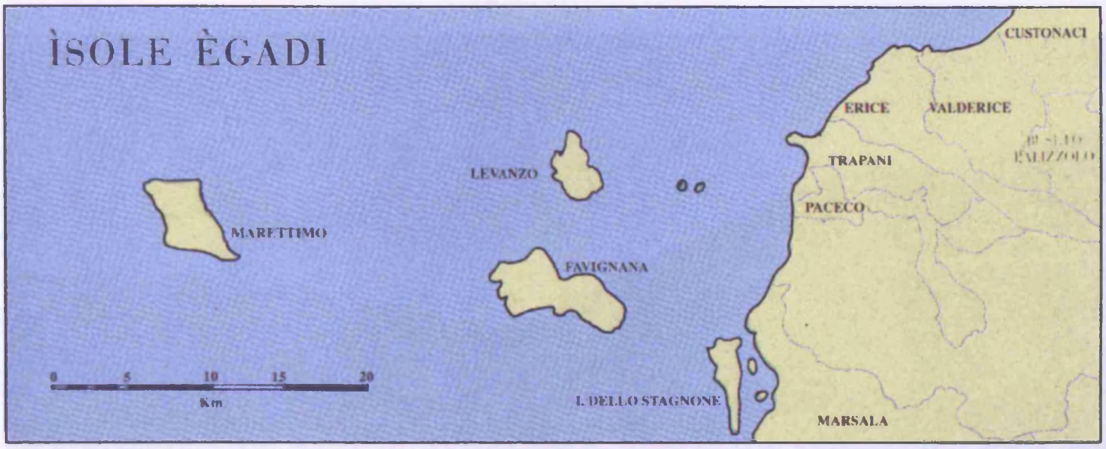


Fig. 4.19. Map of Egadi Islands (western coast of Sicily) (La Rosa 1993)

Fig. 4.20. Map of Marettimo (La Rosa 1993)

Fig. 4.21. Map of Levanzo (La Rosa 1993)

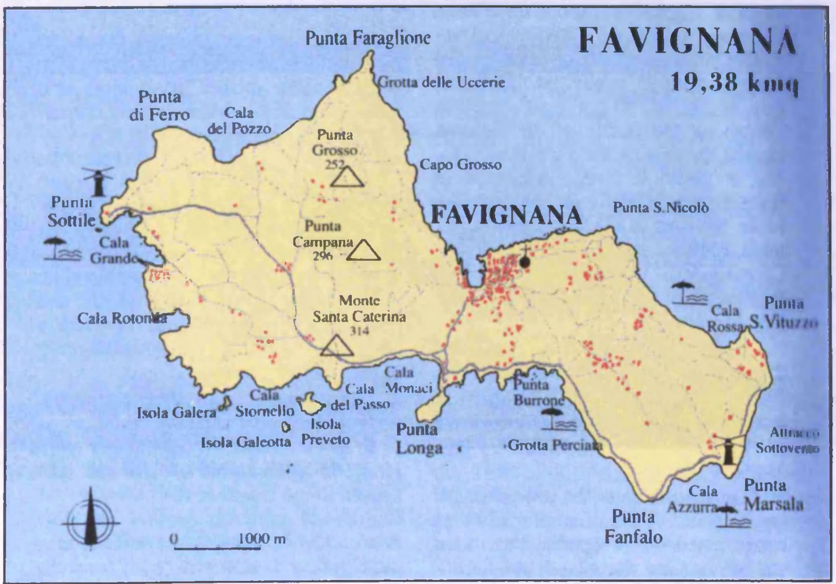


Fig. 4.22. Map of Favignana (La Rosa 1993)

Fig. 4.23. Marettimo, view of interior

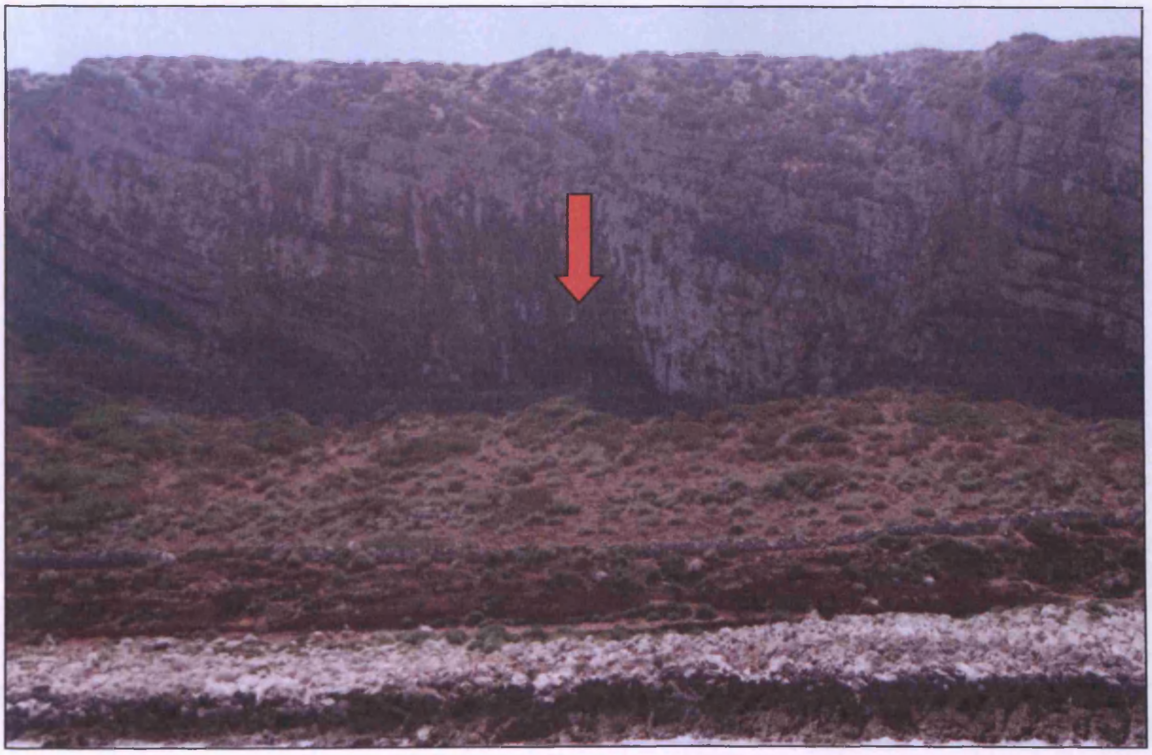


Fig. 4.24. View towards Grotta del Genovese, Levanzo

Fig. 4.25. Neolithic art inside Grotta del Genovese, Levanzo (from a postcard)

Fig. 4.26. Favignana as seen from Levanzo

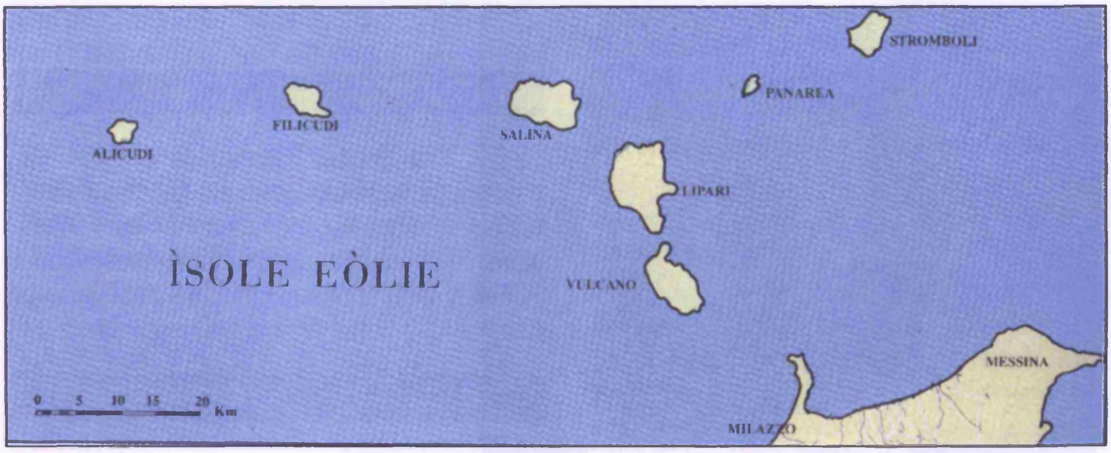
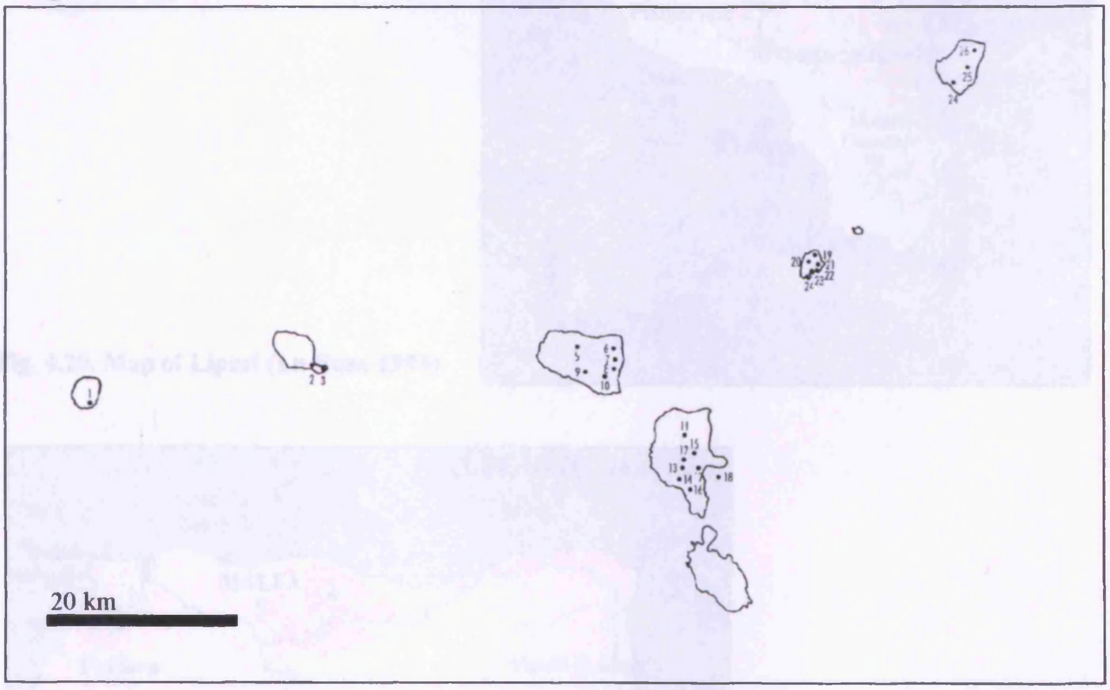


Fig. 4.27. Map of Aeolian Islands (La Rosa 1997)



1) Fucile, *Capo Graziano;* 2) Piano del Porto, Casa Lopez, *Stentinello- Castellaro Vecchio; Capo Graziano;* 3) Montagnola di Capo Graziano, *Diana; Capo Graziano; Milazzese; Ceramica Micenea;* 4) Secca di Capo Graziano, *Ceramica Micenea;* 5) Malfa, *Capo Graziano;* 6) Portella, *Milazzese; Ceramica Micenea;* 7) Serro dei Cianfi, *Capo Graziano; Milazzese; Ceramica Micenea;* 8) Serro del Brigadiere, *Diana;* 9) Rinicedda, *Stentinello-Castell. Vecchio;* 10) Fossa delle Felci, *Diana;* 11) Castellaro Vecchio, *Stentinello-Castellaro; Tricrom.; Diana; Capo Graziano;* 12) Piano Conte, *Serro d'Alto; Diana; Piano Conte;* 13) Spatarella, *Diana;* 14) Predio Megna, *Diana; Capo Graziano;* 15) Diana, *Diana; C. Graziano;* 16) Urnezzo, *Milazzese;* 17) Acropoli, *Castellaro Vecchio-Stentinello; Tricrom.; Serra d'Alto; Diana; Piano Conte; Piano Quartara; Capo Graziano; Milazzese; Ausonio I-II;* 18) Pignataro, *Capo Graziano;* 19) Calcara, *Diana; Capo Graziano;* 20) Timpone del Corvo, *Diana;* 21) Piano Quartara, *Diana; Piano Quartara; Capo Graziano;* 22) Punta di Peppa Maria, *Capo Graziano;* 23) Drauto, *P. Quartara;* 24) Milazzese, *Serra d'Alto; Capo Graziano; Milazzese;* 24) Pianicelli, *Piano Quartara;* 25) Serra Fareddu, *Piano Conte;* 26) San Vincenzo, *Capo Graziano.*

Fig. 4.28. Map of archaeological sites in the Aeolian Archipelago (Balistreri *et al.* 1997)

Fig. 4.29. Map of Lipari (La Rosa 1993)

Fig. 4.30. Map of Salina (La Rosa 1993)

Fig. 4.31. Map of Vulcano (La Rosa 1993)

Fig.4.32. View of Vulcano and main crater (Gran Cratere)

Fig. 4.33. Map of Pelagie Islands (La Rosa 1993)

Fig.4.34. Map of Lampedusa (La Rosa 1993)

Fig 4.35. Map of Linosa (La Rosa 1993)

Fig. 4.36. Map showing location of Pantelleria in the Southern Mediterranean (Times Atlas of the World)

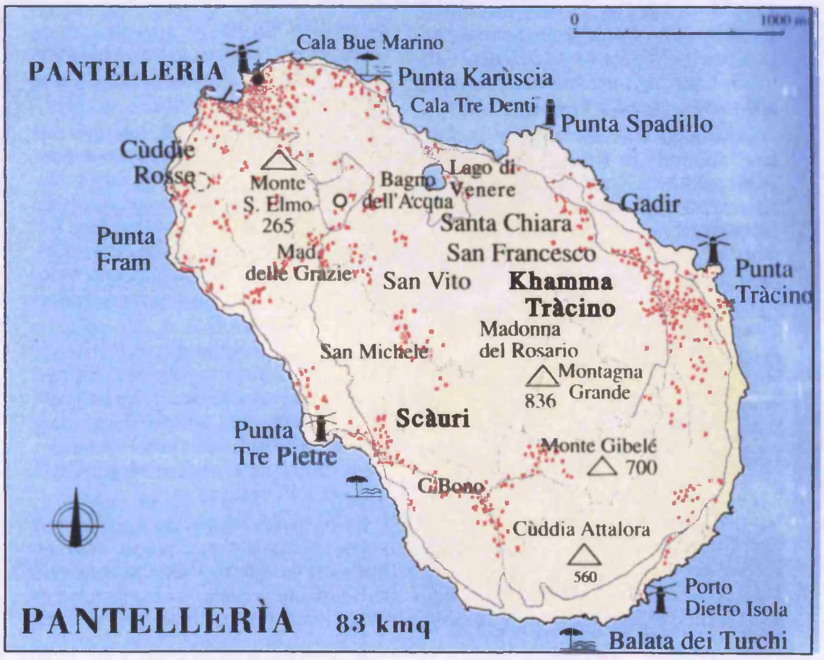


Fig. 4.37. Map of Pantelleria (La Rosa 1993)

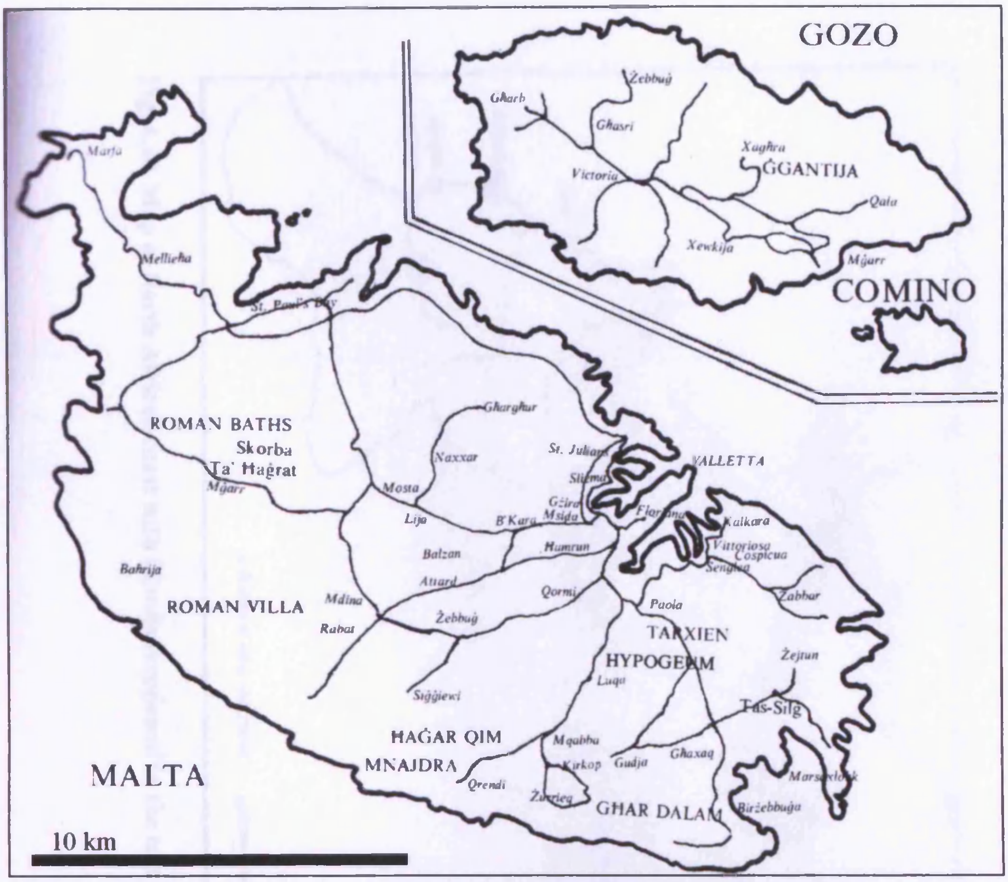


Fig. 4.38. Map of Maltese archipelago (Bonanno 2000)

Fig. 4.39. Aerial view of Malta (Cilia *et al.* 2004)

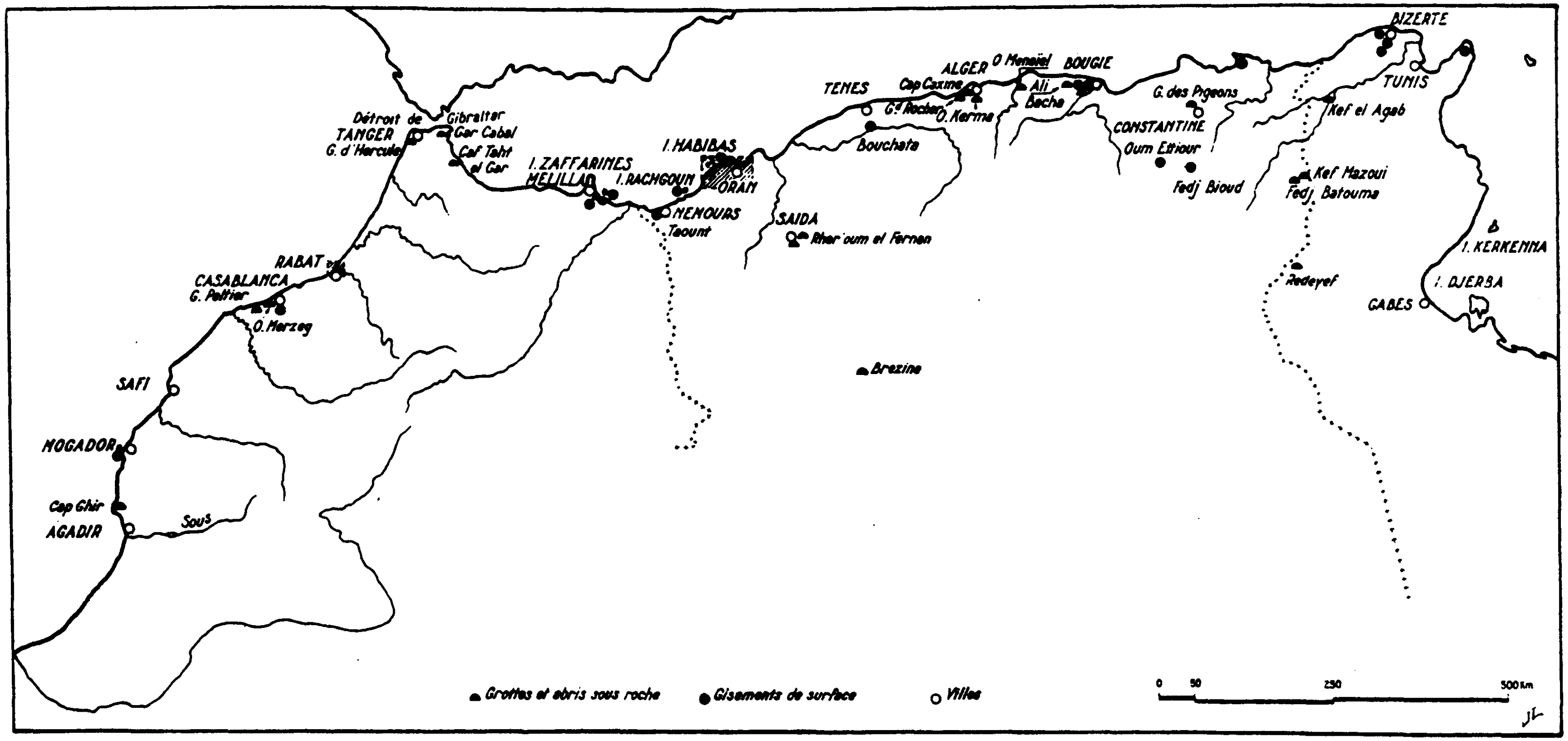


Fig. 4.40. Map of North African coast with islands mentioned in the text (Souville 1958: 316)

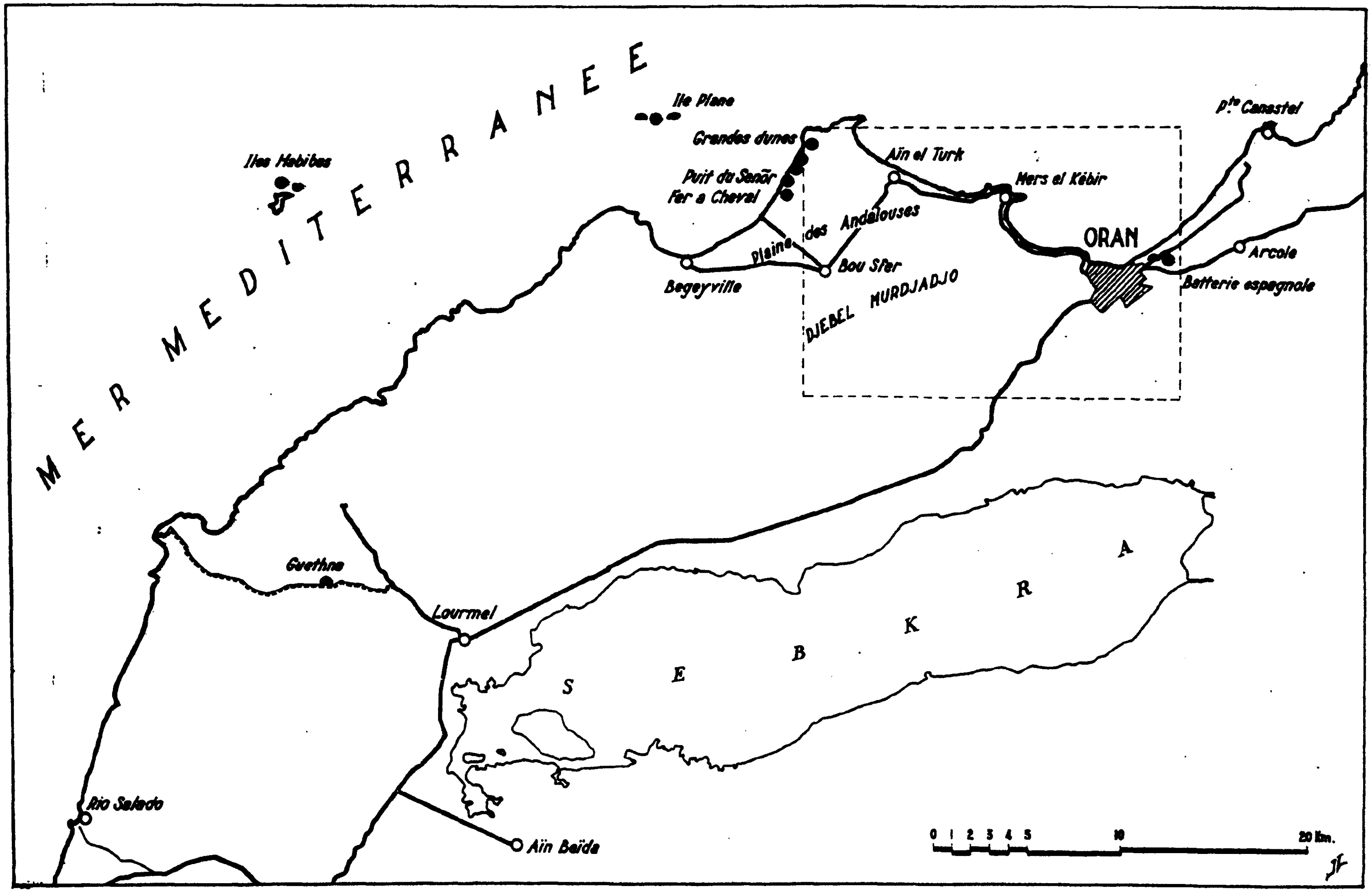


Fig. 4.41. Map of western Algerian coast with islands mentioned in text (Souville 1958: 318)

Fig. 4.42. Map of south-eastern Tunisia (Jerba and Kerkennah Islands) (Times Atlas of the World)

Fig. 4.43. Map of Lybian-Egyptian coast showing location of Marsa Matruh (Times Atlas of the World)

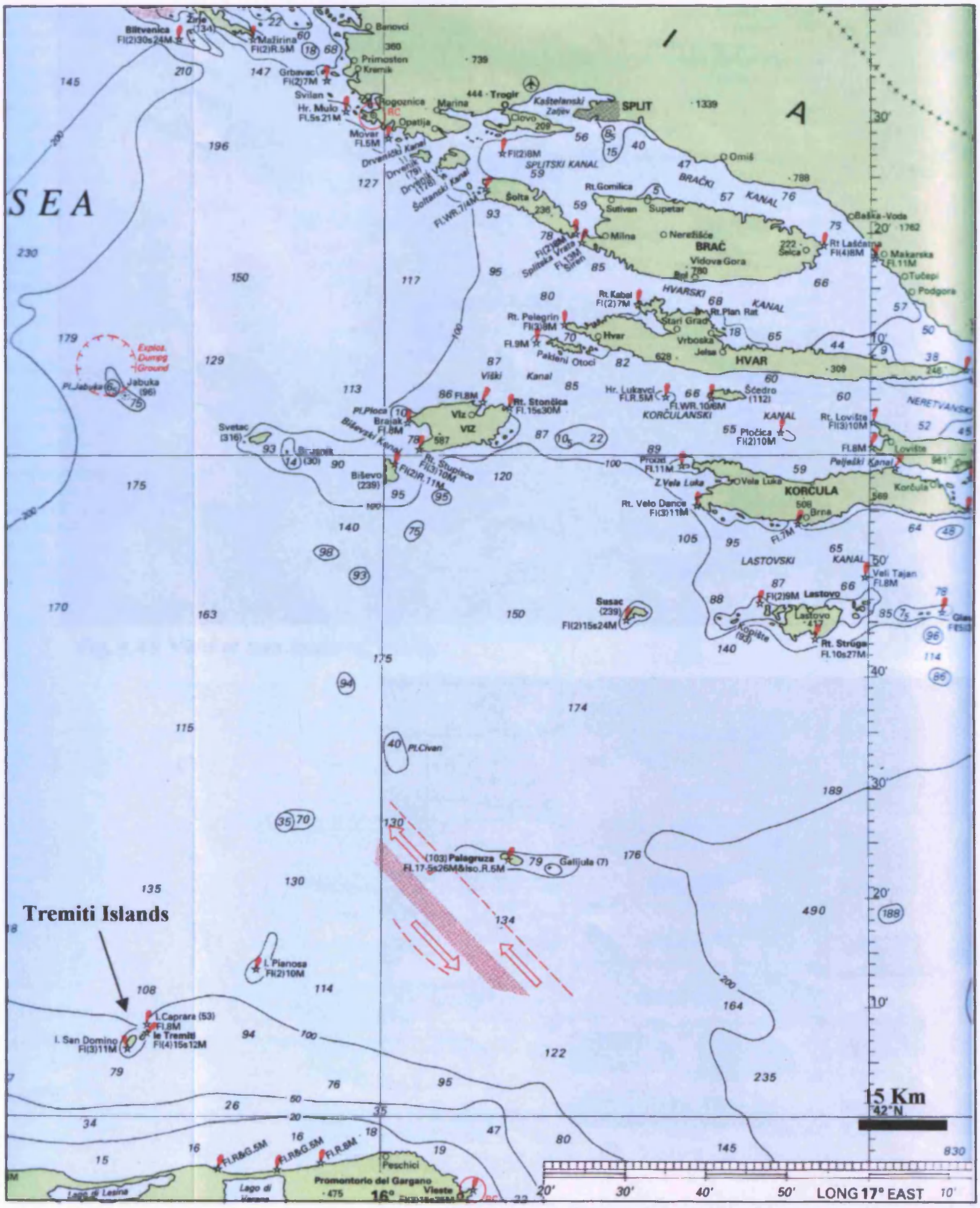


Fig. 4.44. Map of Central Adriatic Island Bridge (Imray Nautical Chart)

Fig. 4.45. View of San Domino, Tremiti

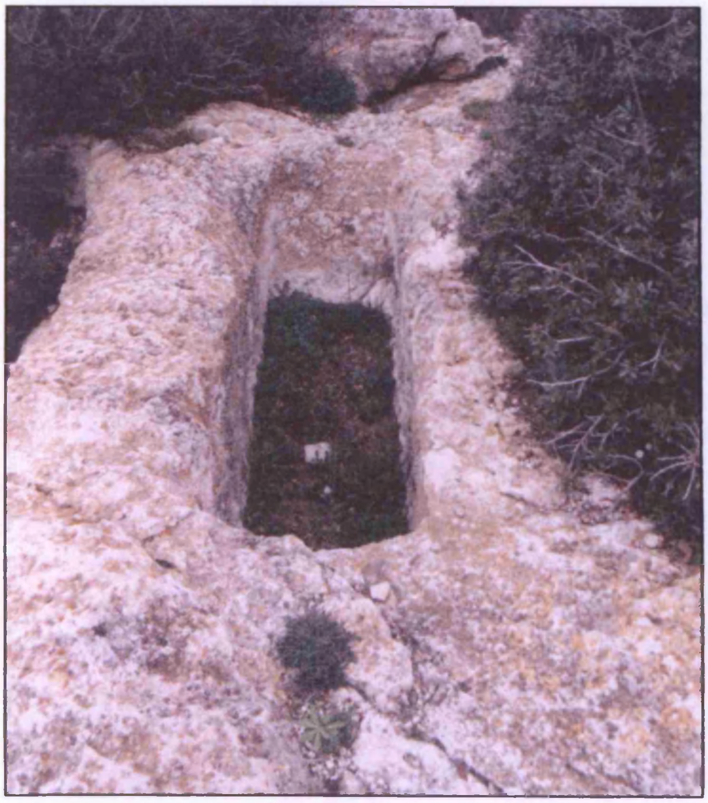


Fig. 4.46. Hellenistic grave, San Nicola

Fig. 4.47. Tomb of 'Diomedes', San Nicola

Fig. 4.48. Cala Tramontana, San Domino

Fig. 4.49. Cala degli Inglesi, San Domino

Fig. 4.50. NE area of San Nicola

Fig. 4.51. Plateau, San Nicola

Fig. 4.52. Cretaccio, Tremiti

Fig. 4.53. Caprara, Tremiti

Fig. 4.54. San Domino, Italian mainland on the horizon

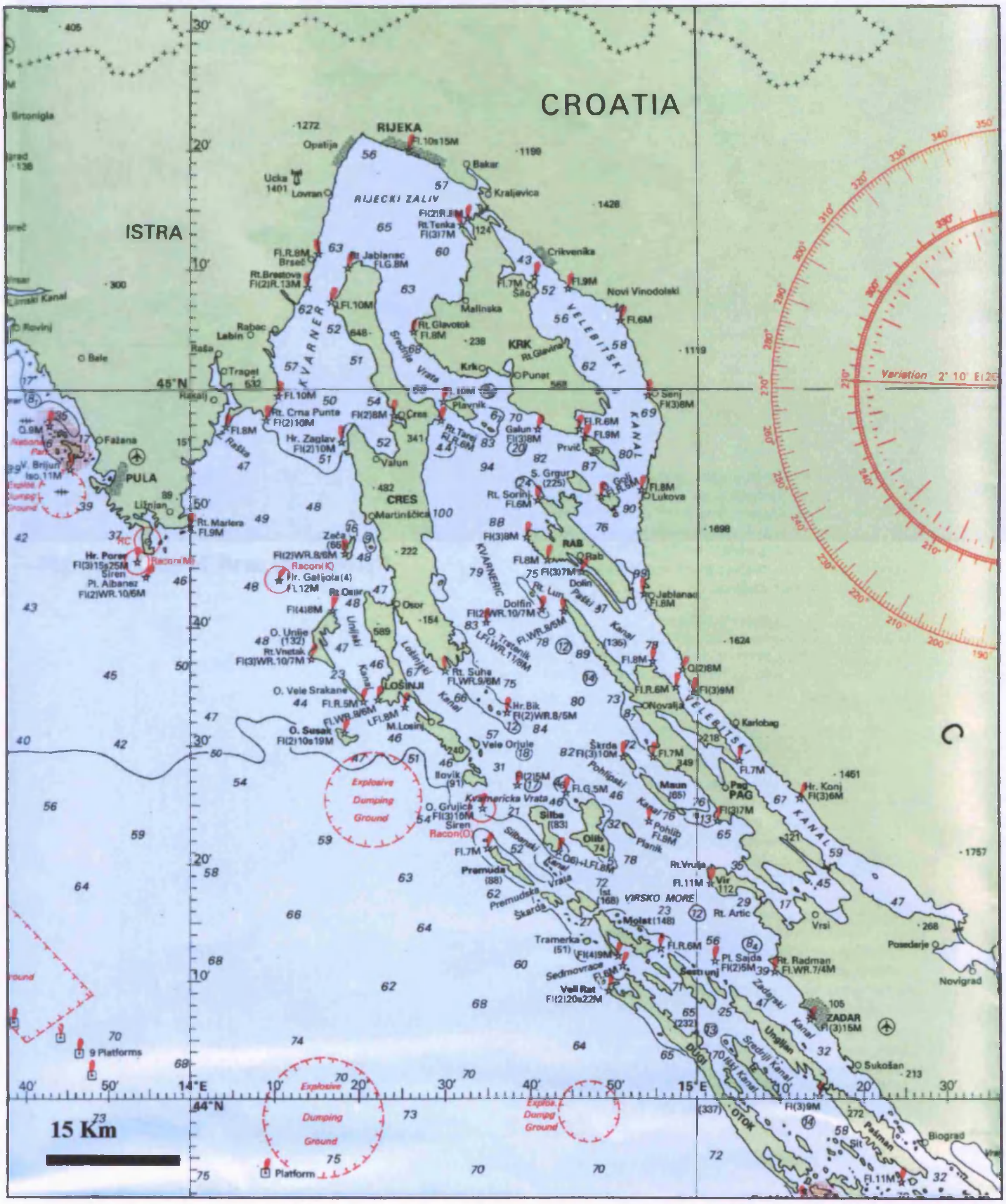


Fig. 4.55. Northern Adriatic Islands (Krk and Cres) (Imray Nautical Chart)

Fig. 4.56. Map of Brac (EuroMap)

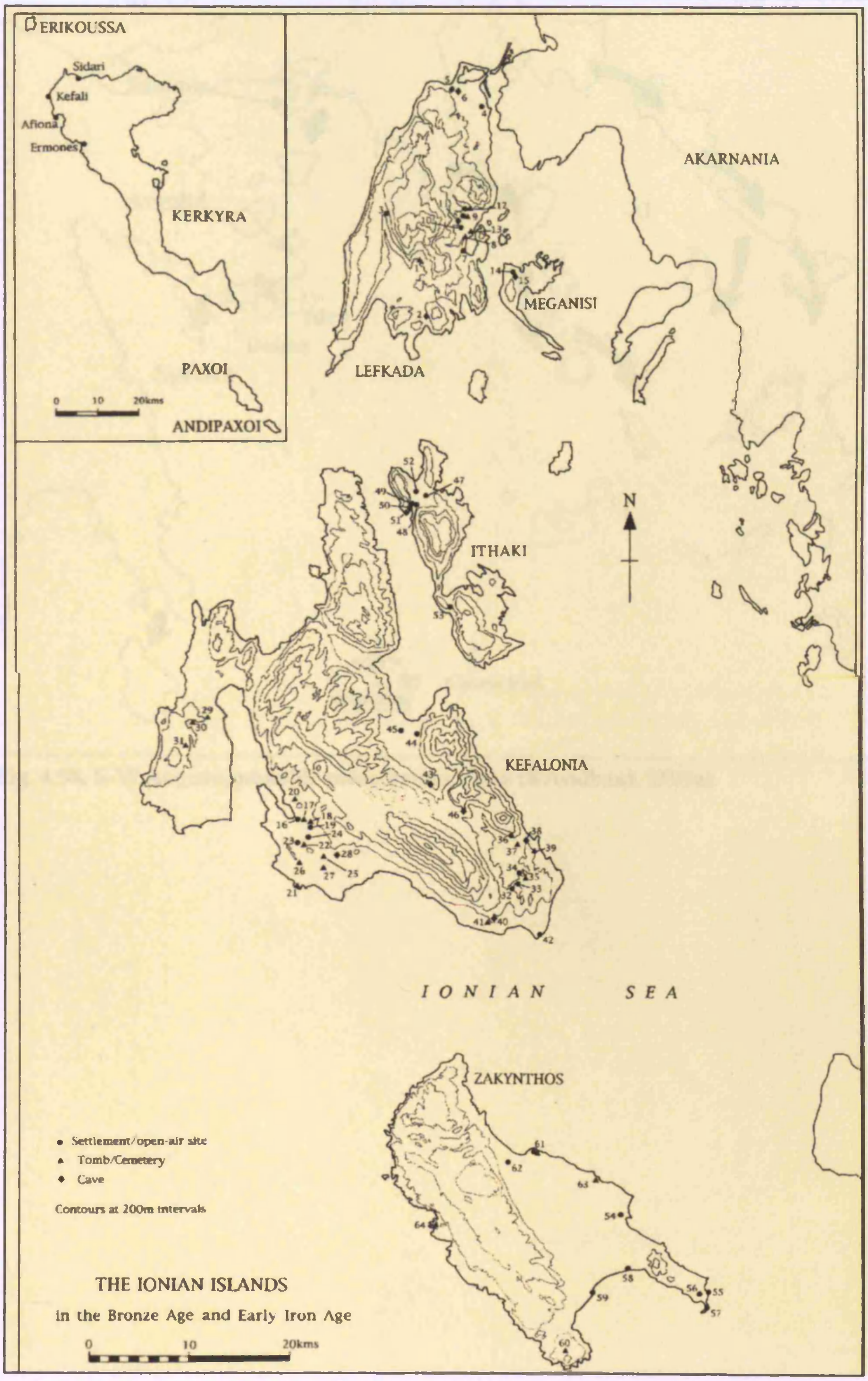


Fig. 4.57. Ionian Islands (Soyoudzoglou-Haywood 1999)

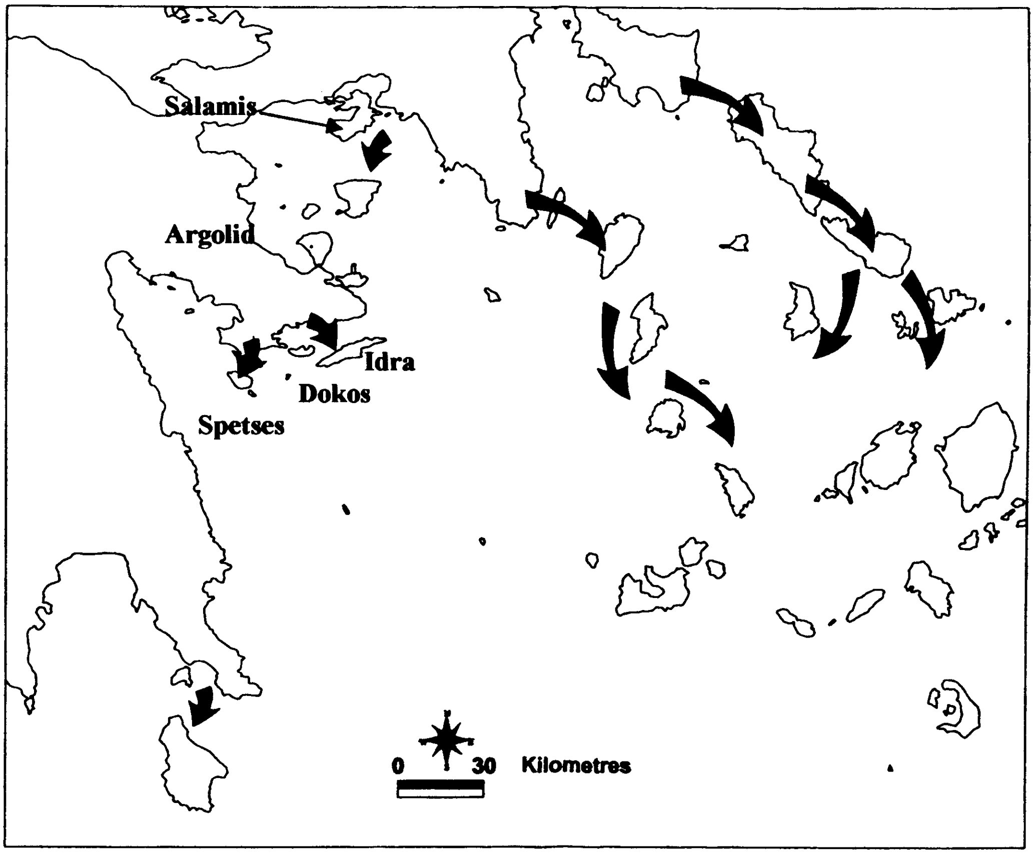


Fig. 4.58. S-W Aegean, possible colonisation route (Broodbank 1999a)

Fig. 4.59. Map of the Aegean showing location of the Cyclades and other main groups mentioned in text (Broodbank 1999a)

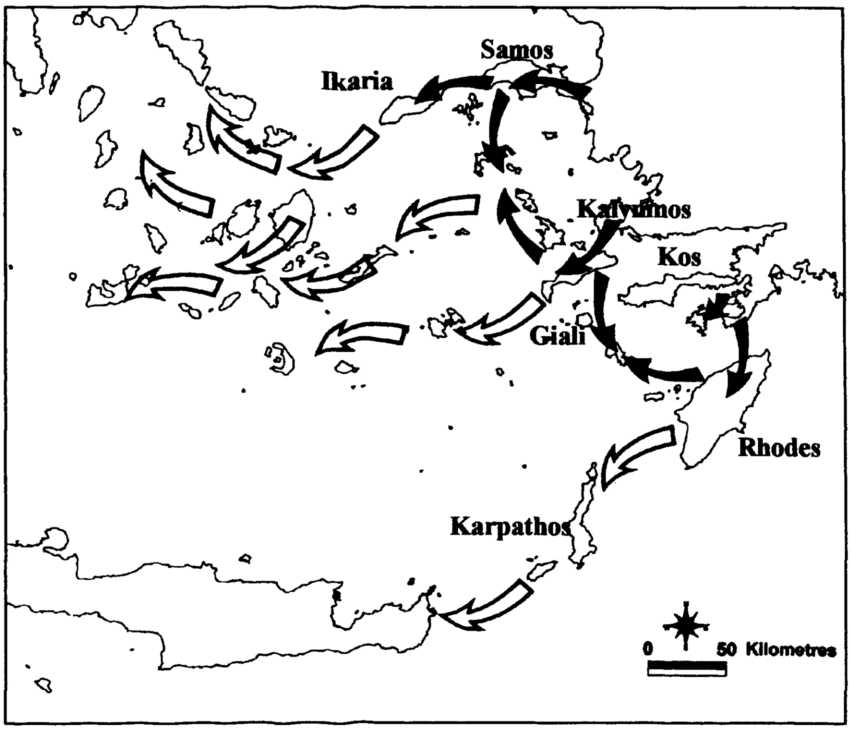


Fig. 4.60. Map of SE-Aegean Islands showing possible colonisation routes (adapted from Broodbank 1999a)

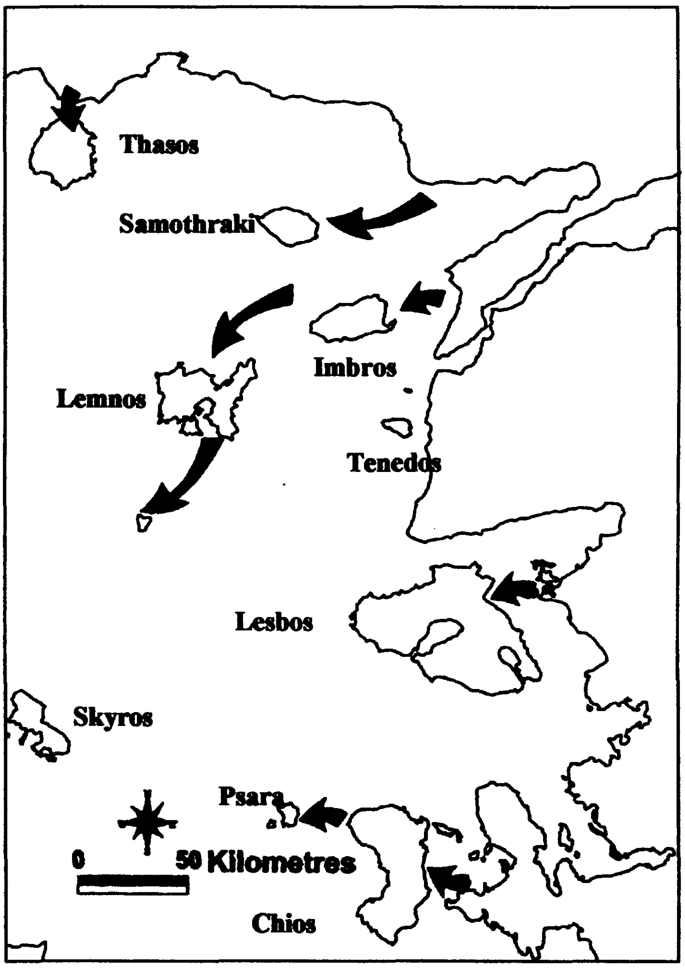


Fig. 4.61. Map of NE Aegean Islands showing possible colonisation routes (adapted from Broodbank 1999a)

Fig. 4.62. Map of Crete (Times Atlas of the World)

Fig. 4.63. Aerial Photo of Crete (Myers *et al.* 1992)

Fig. 4.64. Map of Cyprus (Times Atlas of the World)

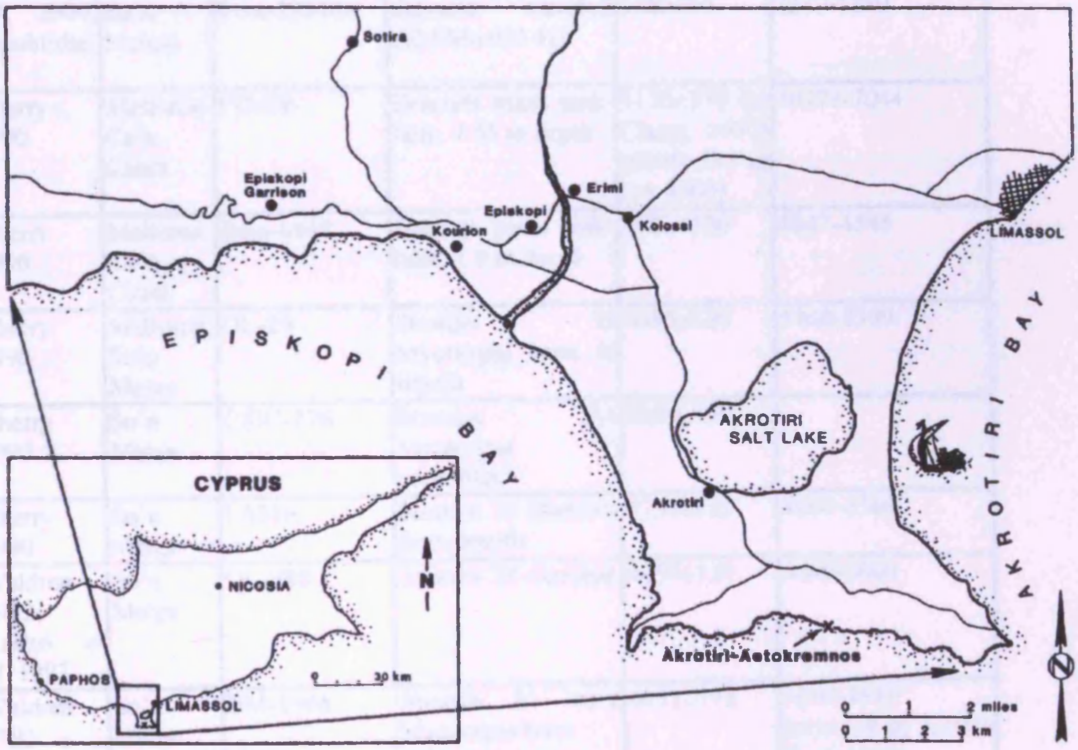


Fig. 4.65. Map of Akrotiri-*Aetokremnos* area (Simmons 1999)

Presettlement	Palaeolithic, Mesolithic, Neolithic	8-6 million years ago - 5600 BC
Early settlement	Neolithic	5600-3900 BC
Pretalayotic	Copper Age, Chalcolithic, Initial Bronze Age	3900-1300 BC
Talayotic	Bronze Ages	1300-1000 BC
Post Talayotic	Iron Ages	1000-123 BC Roman colonisation

Table 4.1 Waldren's (1992) Pentapartite division of Balearic Prehistory

Source	Site	Lab No.	Provenance	Date BP	cal BC 2σ
RA 2000	Mallorca, So'n Moleta		human bones	10686±3517	
Cherry 1990	So'n Moleta	UCLA-1704c	Stratum 7, Myotragus bone	8570±350	
Cherry 1990	So'n Moleta	KBN-640c	Stratum 7, Myotragus bone	7135±80	
Castro *et al.* 1997	So'n Moleta	KBN-640d	Stratum 7, human bone	5935±109	5110-4530
RA 2000, unpublished	So'n Moleta	Beta-135404	thoracic vertebra (SM Mu 031 H)	3680±60	2210-1880
Cherry 1990	Mallorca Ca'n Canet	P-2408	Beneath main sink-hole, 2.55 m depth	9170±570 (in Cherry 1990) (9205±535 in RA 2000)	10173-7044
Cherry 1990	Mallorca Ca'n Canet	Beta-6948	Beneath main sink-hole, 1.0 m depth	6370±320	5847-4545
Cherry 1990	Mallorca, So'n Matge	QL-29	Stratum 35 Myotragus bone in hearth	6680±120	5760-5390
Cherry 1990	So'n Matge	CSIC-176	Stratum 34 Myotragus coprolites	5820±360	
Cherry 1990	So'n Matge	I-5516	Stratum 33 charcoal from hearth	5750±115	4860-4360
Waldren 1982; Castro *et al.* 1997	So'n Matge	QL-988	Stratum 28 charcoal	4650±120	3690-3000
Waldren 1992	So'n Matge	BM-1408	Stratum 26 latest Myotragus bone	4093±392	3690-1610 (rejected by Castro *et al.* 1997)
Castro *et al.* 1997	So'n Matge	Y-2682	charcoal	3820±120	2570-1910
Castro *et al.* 1997	So'n Matge	BM-1995R	charcoal	3770±100	2460-1900

Castro *et al.* 1997	So'n Matge	IRPA-835	?	3700±60	2260-1910
Castro *et al.* 1997	So'n Matge	CSIC-179	charcoal	3620±80	2190-1730
RA 2000	Mallorca, Son Gallard	BM-1994R	charcoal	5160±100	4240-3730
Castro *et al.* 1997	Mallorca, So'n Gallard	Y-1789	charcoal	3790±80	2440-2050
Cherry 1990	Muertos Gallard	BM-1994	Charcoal, earliest pottery horizon	4760±50	3640-3490
Castro *et al.* 1997	Mallorca, Ca na Cotxera	I-5515	charcoal	3750±120	2490-1800
Castro *et al.* 1997	So'n Ferrandel l-Olesa	BM-1843R	charcoal	4030±60	2870-2240
Castro *et al.* 1997	So'n Ferrandel l-Olesa	QL-1636	charcoal	3790±90	2470-1940
Castro *et al.* 1997	So'n Ferrandel l-Olesa	QL-1592	charcoal	3700±30	2170-1950
Castro *et al.* (1997)	Mallorca, So'n Ferrandel l-Olesa	BM-1981R	charcoal	3640±100	2290-1700
RA 2000, unpublished	Mallorca, Cova Estreta	UtC-5171	Myotragus bone	5720±60	6568-6418
RA 2000	Mallorca, Cova des Moro	UtC-7878*	Human bone		2470-2130
RA 2000	Mallorca, Cova des Moro	Beta-155645*	Caprine jaw		2290-2030
RA 2000	Mallorca, Coval Simó	Beta-154196*	Caprine bone		2300-2030
RA 2000	Menorca, Biniai Nou	UtC-8949*	Human bone		2200-1970
Cherry 1990	Formentera, Ca na Costa	BM-1677	Human bone	3270±80	1700-1400
Cherry 1990	Ibiza, Ca'n Sargent	BM-1510	Human bone from tomb	2500±100	830-380
Cherry 1990	Ca'n Sargent	BM-1511	Human bone from tomb	2670±60	910-780
Costa and Benito 2000	Puig de Ses Torretes, Ibiza	UtC-8319*	Cattle bone		2140-1880

RA 2000, unpublished	Cabrera, Cova des Penyal Blanc	UtC-6517	Myotragus bone	6517±40	3596-3520

Table 4.2. Radiocarbon dates for the Balearic and Pitiussae islands referred to in the text
RA= Ramis and Alcover, please see Cherry 1990 and RA 2000 for original sources not mentioned here
■ Earliest date for human occupation according to RA 2000

Period	Years cal. BC
Occasional arrivals and Neolithic occupation	ca. 5000-2500 BC
Early Beaker Phase	ca. 2500-2000
Late Beaker Phase	ca. 2000-1750
Dolmenic	ca. 1750-1600
Early Naviform	ca. 1600-1450/1400
Middle Naviform	ca. 1450/1400-1200
Late Naviform	ca. 1200-1050
Prototalayotic	ca. 1050-850
Talayotic	ca. 850-600/500
Post-talayotic	ca. 600/500-123

Table 4.3. Chronological scheme for the Balearic Islands according to Lull *et al.* (2002)

Lab No.	Provenance	Date BP	cal BC 95%
UtC-718	Hall 1 Layer F	17700±200	19757-19145-18475
UtC-725	Hall 1 Layer E – base	14600±200	16002-15532-15047
UtC-242	Hall 2 Layer 3 level 5	14370±190	15730-15274-14798
UtC-239	Hall 2 Layer 3 level 7	13620±180	14853-14371-13843
GrN-11405	Hall 2 Layer 3	13590±140	14729-14332-13904
UtC-244	Hall 2 Layer 3 level 4	13530±170	14722-14253-13738
UtC-240	Hall 2 Layer 3 level 6	13510±180	14720-14226-13680
UtC-722	Hall 1 Layer D - mid	13500±300	14982-14213-13636
UtC-724	Hall 1 Layer E-mid	13500±300	14731-14213-13636
UtC-721	Hall 1 Layer C-base	13100±190	14221-13644-12956
UtC-720	Hall 1 Layer C-mid	12500±150	13241-12699-12217
UtC-241	Hall 2 Layer 3 level 2	11980±140	12461-12018-11641
UtC-719	Hall 1 Layer C-top	11200±170	11546-11158-10819
UtC-250	Hall 2 Layer 2 – mid/base	11040±130	11283-11005-10736

UtC-14/237	Hall 2 Layer 2 – mid	9820±140	9812-9044-8539
[redacted]	Hall 2 level 2 (60-85)	9120±380	[redacted]
UtC-726	Hall 1 Layer B-base	8960±110	8321-8018-7705
UtC-300	Hall 2 Layer 2 – mid/top	8750±140	8039-7877-7812-7710-7497
UtC-235	Hall 2 Layer 2 - top	8160±130	7486-7192-7189-7134-7127-7049-6652
UtC-22	Hall 2 level 1b	8040±180	7480-7008-6462
UtC-301	Hall 2 Layer 2 – top	7860±130	7043-6617-6418
UtC-1251	Hall 2 level 1b	6690±80	5687-5579-5440
UtC-15/233	Hall 2 Layer 1 – base	6490±90	5576-5433-5259
GrN-11433	Hall 2 Level 1a	6260±180	5563-5226-4783

Table 4.4. Radiocarbon dates for Grotta Corbeddu (Sardinia)
▌ Earliest accepted date for human occupation on Sardinia (from Tykot 1994: 130-131)

Source	Site	Lab No.	Provenance	Date BP	cal BC 2σ
Tykot 1994	Strette	Ly-2837	Layer XXIV	9140±300	9015-8091-7538
Tykot 1994	Curacchiaghiu	Level 7	Gif-795	8560±170	7967-7543-7106
Tykot 1994	Araguina-Sennola	Level XVIIIa, hearth	Gif-2705	8520±150	7923-7535-7105
Tykot 1994	Curacchiaghiu	Layer 7	Gif-1963	8300±130	7546-7412/7363/7313-7007
Tykot 1994	Curacchiaghiu	Layer 6c	Gif-1962	7600±180	6994-6419-6038
Tykot 1994	Curacchiaghiu	Layer 6a	Gif-1961	7310±170	6456-6156/6144/6125/6084/6070-5779
Tykot 1994	Curacchiaghiu	Level 6	Gif-796	7300±160	6426-6122/6087/6063-5805
Tykot 1994	Araguina-Sennola	Level XVII hearth	Gif-2325	6650±140	5742-5571/5546/5526-5283
Vigne and Desse-Berset 1995	Pietracorbara	LGQ 508	layer 9	6920± 300	8th-6th mill.

Vigne and Desse-Berset 1995	Pietracorbara	LGQ507	layer 8	7840 ± 310	9th-8th mill.
Vigne and Desse-Berset 1995	Longone	LGQ 617	layer 4a2	6320±140	
Vigne and Desse-Berset 1995	Monte Leone		layer 5	8225±80 BP	9th-8th mill.

Table 4.5. Selected Radiocarbon dates for Corsica

Period	Culture	Years cal BC
Upper Palaeolithic	Aurignacian, Fontana Nuova (Sicily)	35,000
	Final Epigravettian, Acqua Fitusa/San Teodoro	18,000
Mesolithic	Mesolithic, Uzzo, Genovesi, Perriere Sottano (Sicily)	10,000-6500
Early Neolithic	Uzzo-Aceramic	7000-6500
	Castellaro Vecchio (Lipari)	6000
	Uzzo-Pre-Stentinello	5700-5400
	Stentinello-Ghar Dalam	5700-4500
Middle Neolithic	Lipari Trichrome/Serra D'Alto	4500 (4200)-3800
	Malta Grey Skorba	?4500-4000
Late Neolithic	Malta Red Skorba/Zebbugg	4300-3500
	Lipari Diana	4000-3500
Early Copper Age	San Cono/Piano Notaro/Piano Vento (Sicily), Piano Conte (Lipari)	3500-3000
Late Copper Age	Serraferlicchio/Conca D'Oro/Malpasso/Beaker (Sicily), Piano Quartara (Lipari)	3000-2500
Early Bronze Age	Capo Graziano I-II (Lipari)	2500-1500
Middle Bronze Age	Milazzese	1500-1200
Late Bronze Age	Ausonian I-II	1200-900
Early Iron Age	Ausonian II	900-850

Table 4.6. Sicilian Chronology (from Leighton 1999 and Malone 2003)

	A	F	Sa	L	P	St	V
Stentinello EN		■	■	■			
Trichrome EN		■	■	■			
Serra D'Alto MN		■	■	■	■		
Diana LN		■	■	■	■		
Piano Conte ECA				■		■	
Piano Quartara LCA				■	■	■	
Capo Graziano EBA	■	■	■	■	■	■	
Milazzese MBA		■	■	■	■		
Ausonio I-II LBA-				■			

Table 4.7. Aeolian Islands. Phases of occupation (adapted from Stoddart 1999: 68; Leighton 1999: 269; Tusa and Balistreri *et al.* 1997: 642)
(A=Alicudi; F=Filicudi; Sa=Salina; L=Lipari; P=Panarea; St=Stromboli; V=Vulcano).

Period	Culture	Years cal BC
Neolithic	Ghar Dalam	5200-4500
	Grey Skorba	4500-4400
	Red Skorba	4400-4100
Temple Period	Zebbug	4100-3800
	Mgarr	3800-3600
	Ggantija	3600-3000
	Saflieni	3300-3000
	Tarxien	3000-2500
Bronze Age	Tarxien Cemetery	2500-1500
	Borg in-Nadur	1500-?
	Bahrija	900-700

Table 4.8. Maltese Chronology (from Cilia *et al.* 2004)

Source	Site	Lab No.	Provenance	Date BP	cal BC 2σ
Bianchini and Gambassini 1973	Sicily, Grotta dell'Acqua Fitusa	F-26	Hearth 'grey layer'	13760±330	15349-13621
Graziosi 1962	Levanzo, Grotta di Cala dei Genovesi	R-566	Trench G.9	11189±120	11185-10577
Piperno 1985	Sicily, Grotta dell'Uzzo	P-2736	Layer 3	10070±90	10187-9051
Piperno 1985	Sicily, Grotta dell'Uzzo	P-2558	Trench C.3	9300±100	8831-8083
Piperno 1985	Sicily, Grotta dell'Uzzo	P-2557	Trench A.16	9180±100	8421-8021
Piperno 1985	Sicily, Grotta dell'Uzzo	P-2556	Trench A.7	9030±100	8331-7919
Piperno 1985	Sicily, Grotta dell'Uzzo	P-2735	Trench F.16-18	8330±80	7531-7049
Aranguren and Revedin 1989-90	Sicily, Perriere Sottano	UtC-1424	Cut 53	8700±150	8031-7440
Aranguren and Revedin 1989-90	Sicily, Perriere Sottano	UtC-1355	Cut 60	8460±70	7575-7315
Piperno 1985	Sicily, Grotta dell'Uzzo	P-2734	Trench F.13-14	7910±70	7032-6544
Piperno 1985	Sicily, Grotta dell'Uzzo	P-2733	Trench F.7-9	6750±70	5750-5490
Barker *et al.* 1969; Trump 2002	Malta, Skorba (GD phase)	BM-378	Wood charcoal, beside wall FB6	6140±160	5433-5691 (5266-4846)
Barker *et al.* 1969; Trump 1996	Malta, Skorba (GD phase)	BM-216	Wood charcoal, beside wall FB6	5760±200	5209-4172
Trump 1996, unpublished	Malta, Brochtorff Circle (T phase)	OxA-3572	Human bone, niche in hypogeum	5380±70	4360-4006
Tusa 1994	Lipari, Acropolis (Diana phase)	R-180	Acr. AP	5000±200	4321-3360
Trump 1996	Malta, Brochtorff Circle (T phase)	OxA-5038	Human bone, E tomb chamber, c. 272	5330±100	4373-3966

Tusa 1994	Lipari, Acropolis (Trichrome phase)	R-366α	Acr. AO-Y	5200±60	4227-3821
Tusa 1994	Lipari, Contrada Diana (Diana phase)	R-182	Diana XXI	4885±55	3790-3529
Trump 1966, 1996	Malta, Skorba West Temple (T phase)	BM-143	wood charcoal, floor deposit	4380±150	3501-2500
Trump 1966, 1996	Malta, Brochtorff Circle (T phase)	OxA-3570	Context 669, human bone	4300±60	3080-2705
Trump 1996, unpublished	Malta, Brochtorff Circle (T phase)	OxA-3574	Context 731, Human bone	4260±60	3029-2667
Trump 1996, unpublished	Malta, Brochtorff Circle (T phase)	OxA-3569	Context 354, Human bone	4250±65	3029-2625
Trump 1996, unpublished	Malta, Brochtorff Circle (T phase)	OxA-3575	Context 760, Human bone	4225±70	3022-2612
Trump 1996, unpublished	Malta, Brochtorff Circle (T phase)	OxA-3573	Context 783, Human bone	4170±65	2920-2580
Trump 1996, unpublished	Malta, Brochtorff Circle (T phase)	OxA-3571	Context 799, Human bone	4080±65	2884-2470
Evans 1961	Malta, Tarxien, south Temple (TC Phase)	BM-141	Carbonised beans in cinerary urns	3880±150	2887-1885
Trump 1996, unpublished	Malta, Brochtorff Circle (TC phase)	OxA-3570	Context 369, Animal bone	3580±75	2140-1740
Renfrew 1972	Malta, Tarxien, south Temple (TC Phase)	BM-711	Carbonised barley in cinerary urn	3354±76	1863-1448
Renfrew 1972	Malta, Tarxien, south Temple (TC Phase)	BM-170	Carbonised beans in cinerary urn	3286±72	1734-1407

Tozzi 1978	Pantelleria, Mursia (RTV phase)	R-671	hut 1, area A, Ib.7	3280±50	1721-1440
Tozzi 1978	Pantelleria, Mursia (RTV phase)	R-669 α	Hut 1, area A, Ibc.5	2930±50	1370-946
Tozzi 1978	Pantelleria, Mursia (RTV phase)	R-673	Hut 4, area A, IVf.3	2830±50	1211-835
Tozzi 1978	Pantelleria, Mursia (RTVM phase)	R-670 α	Hut 3, area A, Vc.3-4, hearth	3010±50	1429-1054
Tozzi 1978	Pantelleria, Mursia (RTVM phase)	R-668 α	Area A, IVbc.4	2990±50	1410-1051
Tusa 1994	Lipari, Acropolis (M phase)	R-365 α	Acr. BF-17	2900±50	1294-931
Tusa 1994	Filicudi, Capo Graziano (M phase)	R-369	Hut 8	3000±50	1410-1053
Tusa 1994	Lipari, Acropolis (A II phase)	R-367	Acr. BR-6	2820±50	1210-834
Tusa 1994	Lipari, Acropolis (A II phase)	R-367α	Acr. BR-6	2770±50	1078-820
Tusa 1994	Lipari, Acropolis (A II phase)	R-181	Acr. BR	2555±50	825-447

Table 4.9 Radiocarbon dates from Sicily and its islands (including Malta*)
GD=Ghar Dalam
T=Tarxien
TC=Tarxien Cemetery
RTV= Rodì-Tindari-Vallelunga
RTVM= Rodì-Tindari-Vallelunga/Milazzese
M=Milazzese
A II= Ausonio II
* Only earliest occupation (Ghar Dalam/Skorba) and Tarxien Temple – Cemetery dates included here.

Source	Site	Lab No.	Provenance	Date BP	cal BC 1σ
Čečuk 1986, Chapman and Müller 1990	Kopačina Cave (Brač)	Z 778	Mollusc deposit above Late Mesolithic	7850±140	7000-6450
Chapman and Müller 1990	Vela Cave (Korčula)	Z 1967	A-phase EN impressed wares	7300±120	6220-5980
Chapman and Müller 1990	Vela Cave (Korčula)	Z 1968	B-Phase EN Impressed Wares	7000±120	5960-5720

Table 4.10 Radiocarbon dates from the Dalmatian Islands (from Bass 1998)

PERIOD	CHRONOLOGY
Middle Neolithic (MN)	Before 5200 cal BC
Late Neolithic (LN)	5200-4200 cal BC
Final Neolithic (FN)	4200-3200 cal BC
Early Bronze Age I (EBI)	3200-2700 cal BC
Early Bronze Age II (EBII)	2700-2200 cal BC
Early Bronze Age III (EBIII)	2200-2000 cal BC
1st Palace – 3rd Palace	2000-1100 cal BC
Post Palatial - Early Iron Age (EIA)	1100-800 cal BC

Table 4.11 Aegean Chronology (Broodbank pers. comm.)

Name	Size	D to NM	Cherry 1981	Cherry 1990	Souyoudzoglou-Haywood 1999
Corfu	593	5	7th mill BC	Mesolithic 7770±340 BP	(P.); Mesol.; EN
Ithaca	96	30	3rd mill BC		LN
Kalamos	25	2	1st mill BC	historical era	
Kephallonia	781	38	3rd/2nd mill BC	MP (ca. 50,000yrsBP); then EBA	(MP); LN
Lefkas	303	0.5	4th/3rd mill BC	LN late 5th mill-4th mill BC	Levallois-Mousterian, MN-LN
Meganisi	20	9	4th/3rd mill BC		
Zakynthos	402	18	2nd mill BC	EBA	Mesol.? LN-EBA?

Table 4.12 Ionian Islands. Geographical and Earliest Colonisation Data
* Data included by Broodbank (1999a) are Neolithic onwards

Name	Size	D to NM	Cherry 1981	Cherry 1990	Broodbank 1999a*
Aegina	83	21	FN 4th mill BC		FN 4th mill BC
Antikythera	20	63	1st mill BC		-
Atokos	5	8	1st mill BC	historical era	
Dokos	20	2			EBA 3rd mill BC
Idra	50	6	EBA 3rd mill BC		EBA 3rd mill BC
Kythera	280	15	EBA 3rd mill BC		LN/FN or EBA 5th -3rd mill BC
Poros	23	0.5	EBA 3rd mill BC		EBA (L. ins.)
Salamis	96	0.5	EBA 3rd mill BC		LN 5th mill BC (L. ins.)
Spetses	22	2	EBA 3rd mill BC		EBA 3rd mill BC

Table 4.13 South-west Aegean Islands. Geographical and Earliest Colonisation Data
L.ins.= late insularisation
* Data included by Broodbank (1999a) are Neolithic onwards

Name	Size	D to NM	Pre-Holocene	Cherry 1981	Cherry 1990	Broodbank 1999a*
Amorgos	124	105		3rd mill BC	LN (late 5th-early 4th mill BC)	LN (5th mill BC)
Anafi	40	152		2nd mill BC		-
Andros	380	55		3rd/2nd mill BC		FN (4th mill BC)
Delos	3	112		3rd mill BC		EBA (3rd mill BC)
Despotiko	8	112		3rd mill BC		LN (5th mill BC)
Donoussa	14	140		3rd mill BC		EBA (3rd mill BC)
Erimonisia	n/a	n/a				EBA (3rd mill BC)
Heraklia	18	155		3rd mill BC		EBA (3rd mill BC)
Ios	109	147		3rd mill BC	3rd mill BC	EBA (3rd mill BC)
Kea	131	22		4th mill BC	FN (4th mill BC)	FN (4th mill BC)
Keros	15	145		3rd mill BC		EBA (3rd mill BC)
Kimolos	36	106		3rd/2nd mill BC		-
Kouphonisia	6	160		3rd mill BC		EBA (3rd mill BC)
Kythnos	100	39	Yes	3rd mill BC?	Mesolithic (8th-7th mill BC)	Mesolithic (8th-7th mill BC); EBA (3rd mill BC)
Makronisos	18	3		4th/3rd mill BC		EBA (3rd mill BC)
Melos	151	105	Yes	4th/3rd mill BC	LN (late 5th-early 4th mill BC)	FN/EBA (4th-3rd mill BC)
Mykonos	86	112		5th mill BC		LN (5th mill BC)
Naxos	430	132		4th/3rd mill BC	LN (late 5th-early 4th mill BC)	LN (5th mill BC)
Paros-Antiparos	196	115		3rd mill BC		LN (5th mill BC)
Pholegandros	32	131		3rd mill BC		EBA (3rd mill BC)
Reneia	14	105		1st mill BC		EBA (3rd mill BC)
Schinoussa	9	157		3rd mill BC		EBA (3rd mill BC)
Seriphos	75	62		2nd/1st mill BC		EBA (3rd mill BC)
Sikinos	43	143		3rd mill BC		-
Siphnos	74	85		3rd mill BC		FN/EBA (4th-3rd mill BC)
Syros	85	75		3rd mill BC		LN/FN or EBA
Thera	76	180		3rd mill BC	LN (late 5th-early 4th mill BC)	LN (5th mill BC)
Therassia**	9	178		2nd mill BC		2nd mill BC
Tinos	195	82		3rd mill BC		-

Table 4.14. The Cyclades. Geographical and Earliest Colonisation Data (from Cherry 1981, 1990; Broodbank 1999a)

Size = sq km
D to NM = distance to nearest mainland (km)
- = inadequate data
* Data included by Broodbank (1999a) are Neolithic onwards
** Part of Thera before the eruption

Name	Size	D to NM	Cherry 1981	Cherry 1990	Broodbank 1999a*
Alimnia	7	40	1st mill BC	LN (late 5th -early 4th mill BC)	FN (4th mill BC)
Arkos	5	10	1st mill BC	1st mill BC	-
Astypalaia	97	79	3rd mill BC	LN (late 5th -early 4th mill BC)	LN/FN (5th -4th mill BC)
Castellorizo	10	5	1st mill BC	1st mill BC	
Chalki	28	47	1st mill BC	LN (late 5th -early 4th mill BC)	FN (4th mill BC)
Giali	9	18	1st mill BC	LN (late 5th -early 4th mill BC)	LN/FN (5th -4th mill BC)
Ikaria	256	47	1st mill BC	EBA (3rd mill BC)	-
Kalymnos	93	18	4th mill BC	LN (late 5th -early 4th mill BC)	LN/FN (5th -4th mill BC)
Karpathos	301	93	2nd mill BC	LN (late 5th -early 4th mill BC)	LN (5th mill BC)
Kasos	69	140	3rd mill BC	LN (late 5th -early 4th mill BC)	LN/FN (5th -4th mill BC)
Kinaros					-
Kos	290	5	4th -3rd mill BC	LN (late 5th -early 4th mill BC)	LN (+earlier?) (5th mill BC)
Leros	53	32	3rd mill BC	LN (late 5th -early 4th mill BC)	LN/FN (5th -4th mill BC)
Levitha					-
Lipsoi	17	37	2nd mill BC	2nd mill BC	-
Nisyros	37	17	3rd mill BC	3rd mill BC	-
Patmos	34	48	2nd mill BC	2nd mill BC	-
Rhodes	1400	19	4th/3rd mill BC	LN (late 5th -early 4th mill BC)	LN (+earlier?)
Samos	477	5	4th mill BC	EBA (3rd mill BC)	LN (5th mill BC)
Saria	21	85	3rd/2nd mill BC	LN (late 5th -early 4th mill BC)	LN/FN (5th -4th mill BC)
Symi	38	8		LN (late 5th -early 4th mill BC)	LN/FN (5th -4th mill BC)
Tilos	63	20		LN (late 5th -early 4th mill BC)	LN/FN (5th -4th mill BC)

Table 4.15 South-eastern Aegean Islands. Geographical and Earliest Colonisation Data

* Data included by Broodbank (1999a) are Neolithic onwards

Name	Size	D to NM	Cherry 1981	Cherry 1990	Broodbank 1999a*
Chios	842	11	4th mill BC	EN? LN	LN (+earlier?) (5th mill BC)
Imbros	279	16			EBA (+Neol?) (3rd mill BC)
Lemnos	478	62	4th mill BC	Neolithic	FN (4th mill BC)
Lesbos	1633	10	3rd mill BC	EBA	LN/FN (5th 4th mill BC)
Psara	40	67	2nd mill BC	LN	LN 5th mill BC
Samothraki	178	37	3rd mill BC	FN/Chalcolithic	FN 4th mill BC
Skyros	210	33	Mousterian, Neolithic	Mousterian; then EN (mid-6th mill BC)	EN 7th -mid 6th mill BC
Tenedos	42	19			EBA 3rd mill BC
Thasos	380	7	4th mill BC	End of Pal.; then LN (late 5th -early 4th mill BC)	MN/LN late 6th -5th mill BC

Table 4.16 North-East Aegean Islands. Geographical and Earliest Colonisation Data
* Data included by Broodbank (1999a) are Neolithic onwards

Name	Size	D to MN	Cherry 1981	Cherry 1990	Broodbank 1999a*
Alonissos	65	43	Mousterian, Neolithic	Mousterian	-
Gioura	20	70			EN 7th-mid 6th mill BC
Kyra Panagia	25	59	6th-5th mill BC	Mousterian; EN (very late 6th mill BC) to MN	Late EN mid 6th mill BC
Peristera					-
Skandzoura					-
Skiathos	50	4	1st mill BC?		-
Skopelos	97	22	2nd mill BC		-

Table 4.17 Northern Sporadhes. Geographical and Earliest Colonisation Data
* Data included by Broodbank (1999a) are Neolithic onwards

Period	Dates BP	Dates cal BC	Type of Activity
Akrotiri	10,665*	9703*	Exploration (hunter-gatherer visitors)
Cypro-EPPNB	?-9000	?-8000	Colonisation (first agro-pastoral settlers)
Cypro-MPPNB	9000-8500	8000-7500	Consolidation (establishment of farmers)
Cypro-LPPNB	8500-8000	7600-7000	Adaptation (development of a distinctive economy)
Khirokitian	8000-6500	7000/6500-5800/5500	Development (efflorescence of Aceramic Neolithic
Sotira	5500-4500	4500/3800	Devolution, ceramic Neolithic

Table 4.18 Chronological scheme for the Aceramic Neolithic of Cyprus (from Peltenburg *et al.* 2000: 847; 2002: 65)
*average of large series of dates (Simmons 1999)

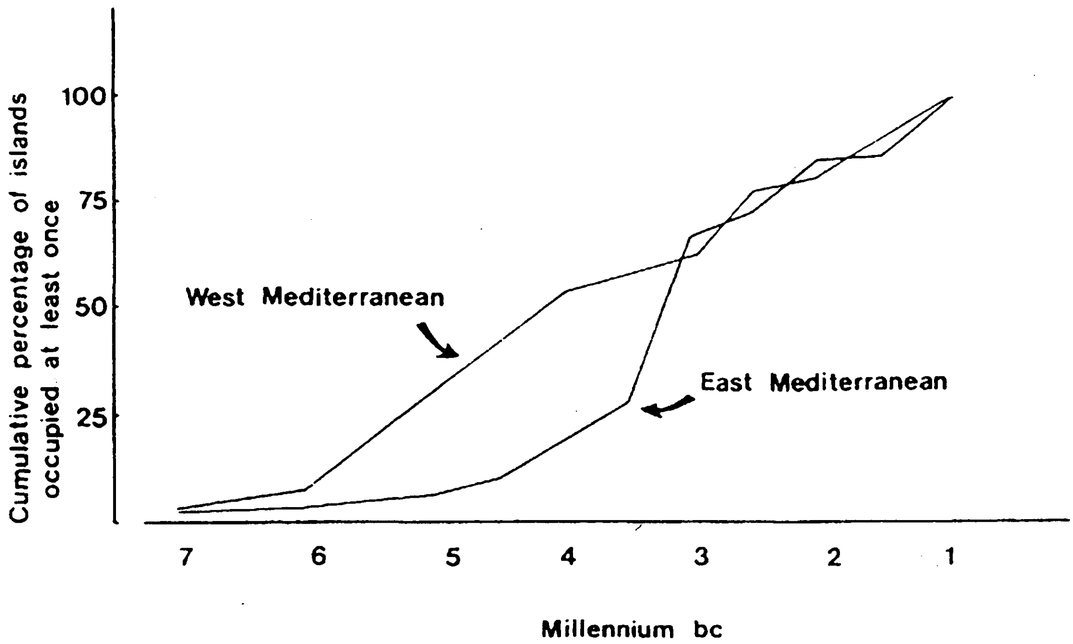


Fig.5.1. Cumulative Percentage Colonisation Plot (Cherry 1981)

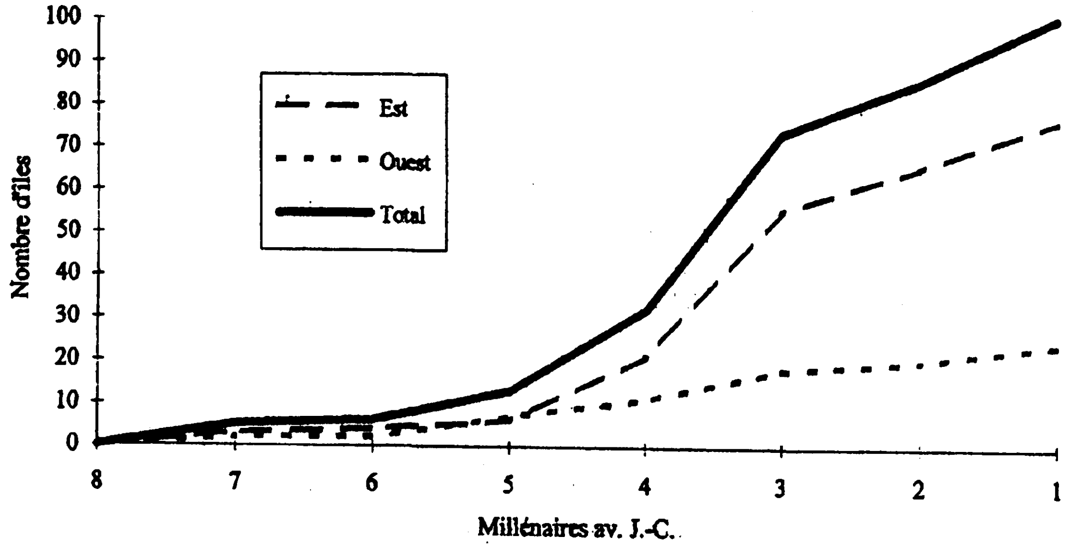


Fig. 5.2. Cumulative Colonisation Plot (Vigne 1996)

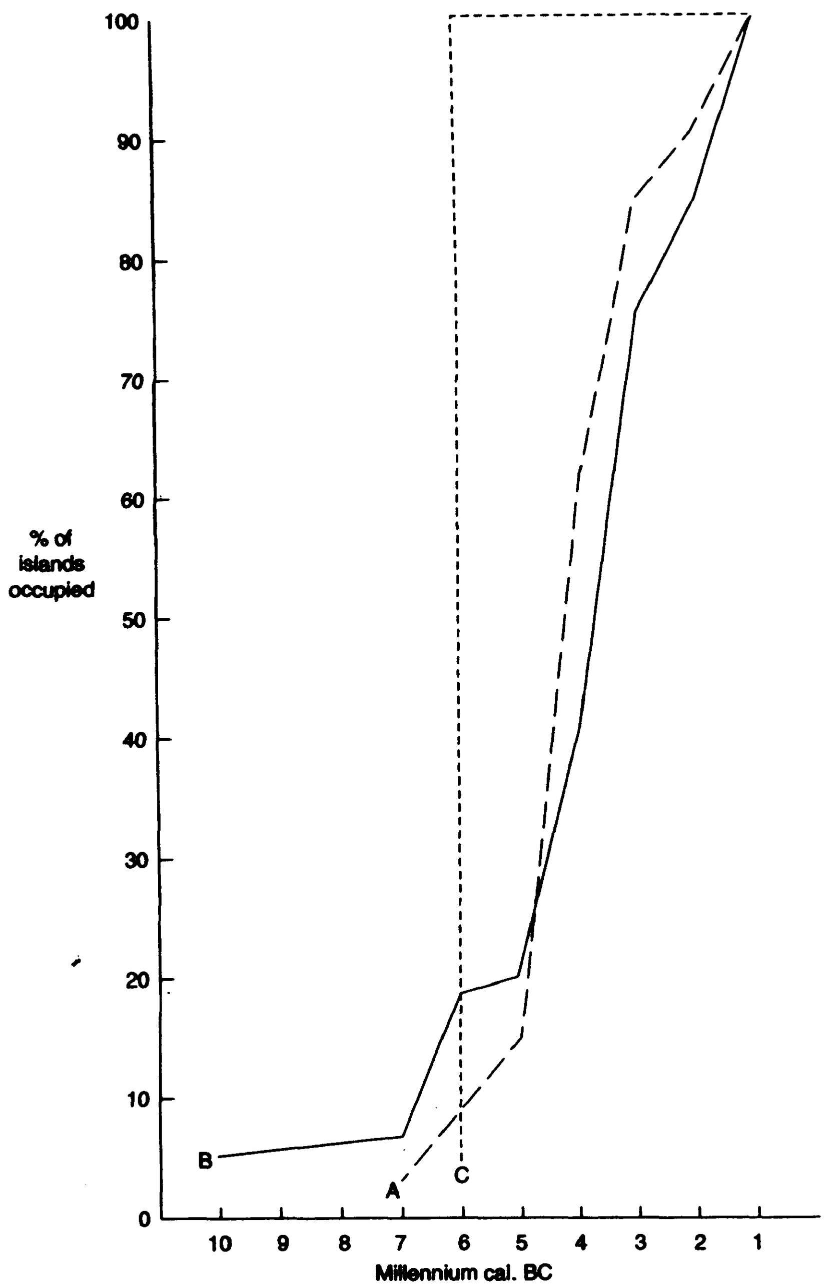


Fig. 5.3. Cumulative Colonisation Plot (Patton 1996)

A: Islands visible from the mainland

B. Islands visible from nearest other island

C. Islands not visible from nearest island/mainland

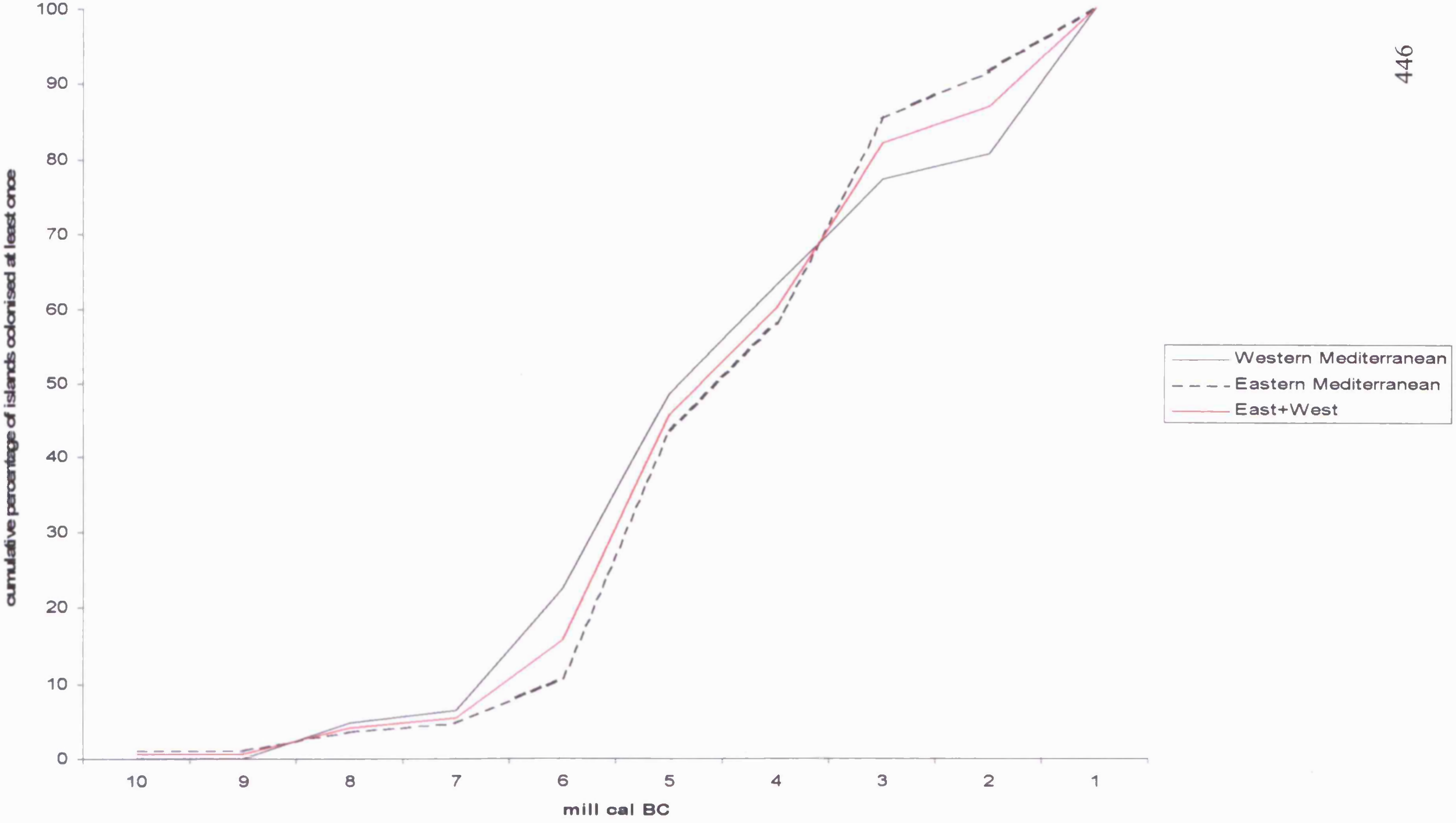


Fig. 5.4. Reworked Cumulative Colonisation Plot.

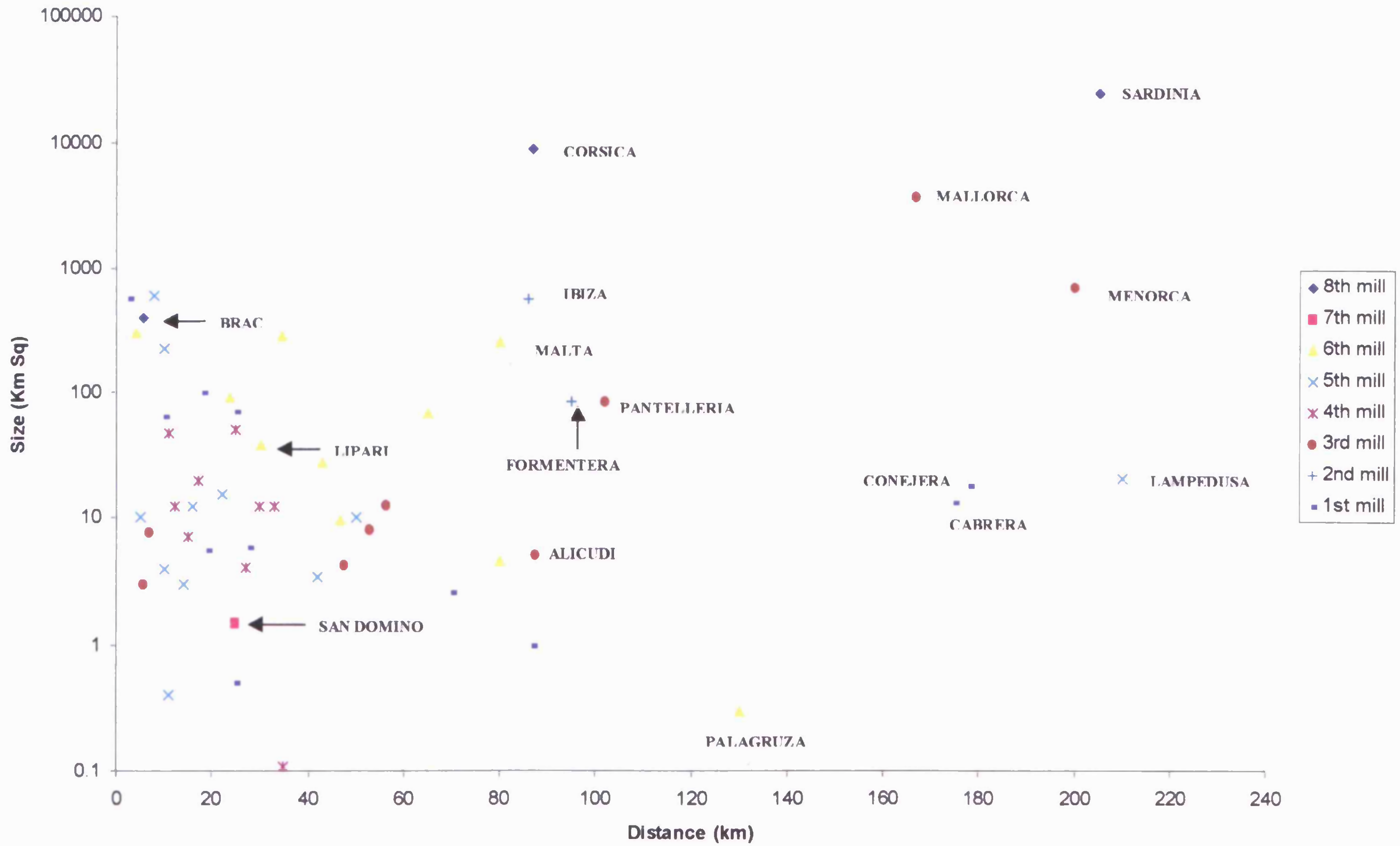


Fig. 5.5. Western Mediterranean. Colonisation scatter-plot showing islands colonised during each millennium cal BC.

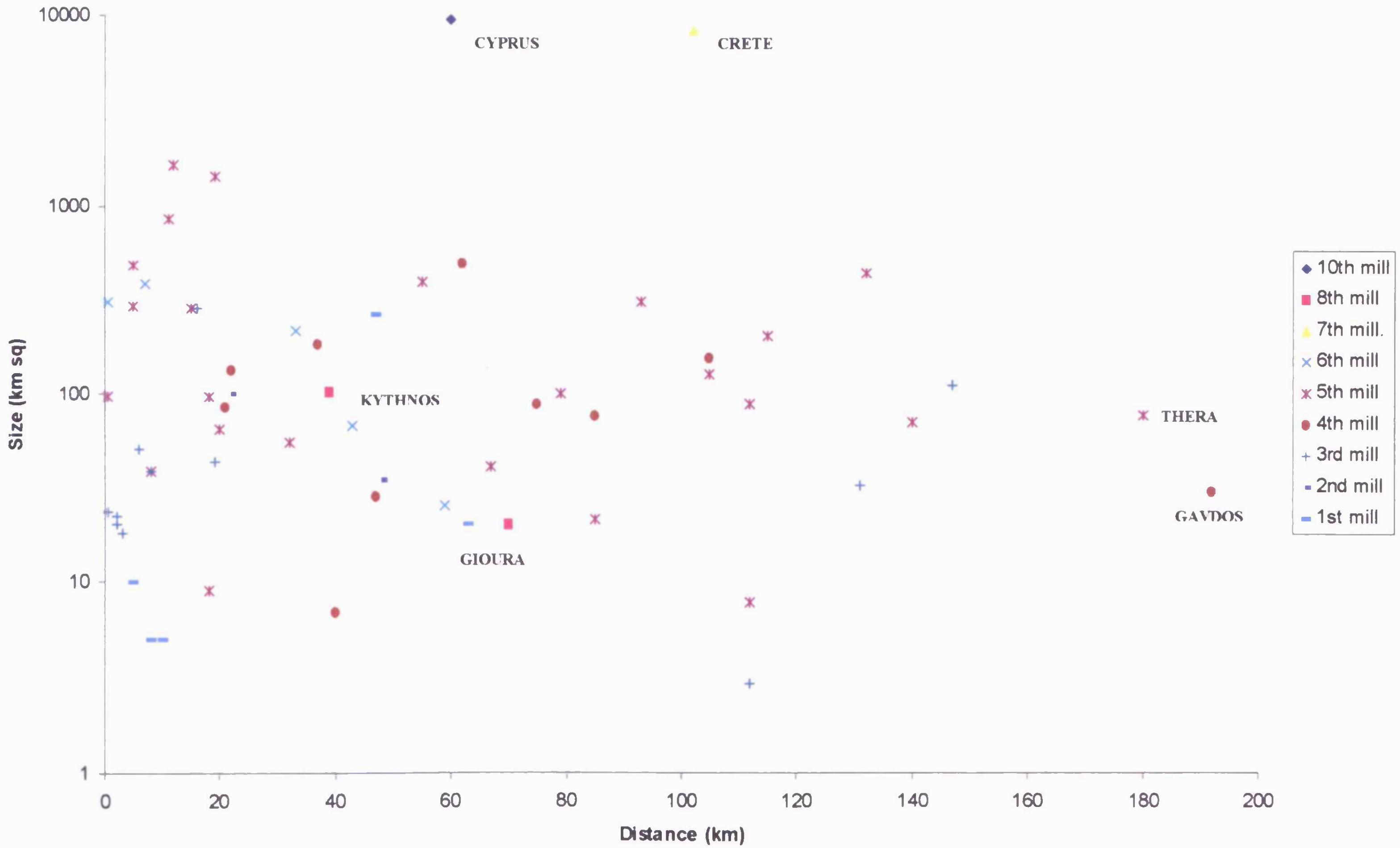


Fig. 5.6. Eastern Mediterranean. Colonisation scatter-plot showing islands colonised during each millennium cal BC.

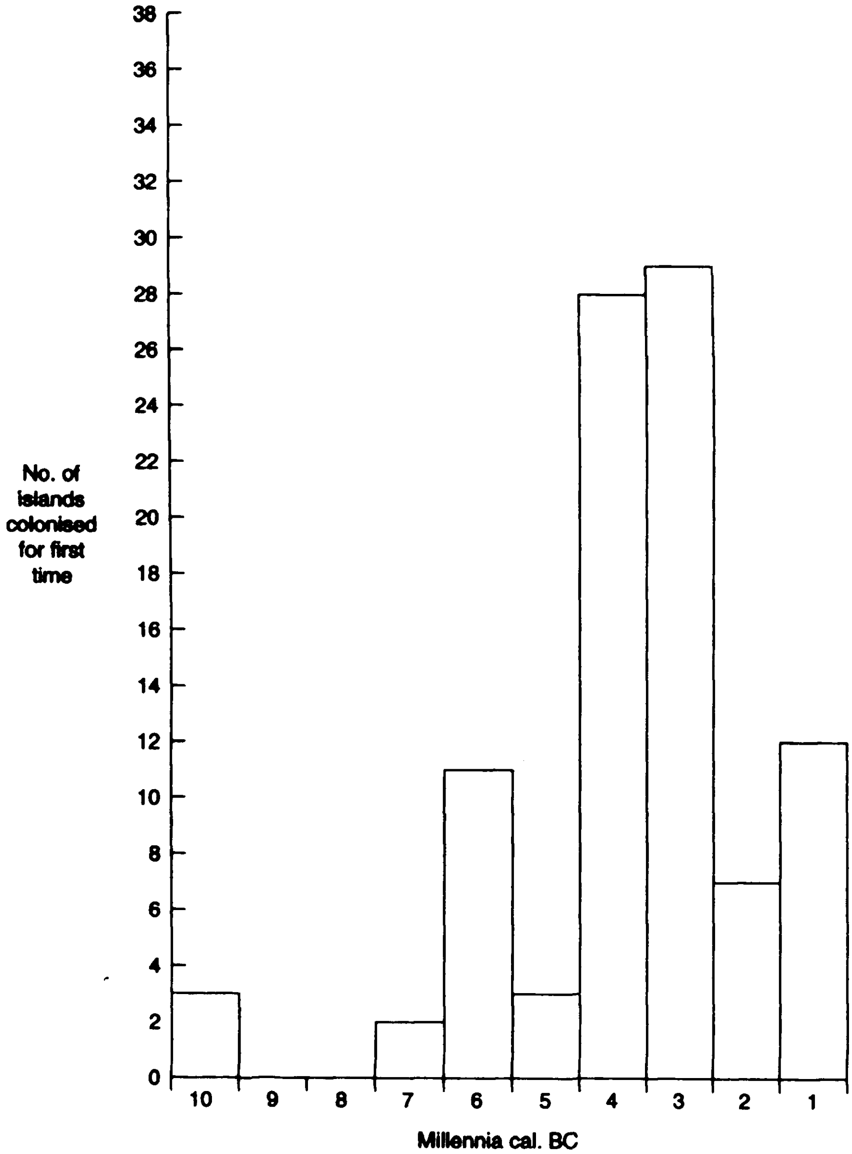


Fig. 5. 7. Colonisation Histogram (Patton 1996)

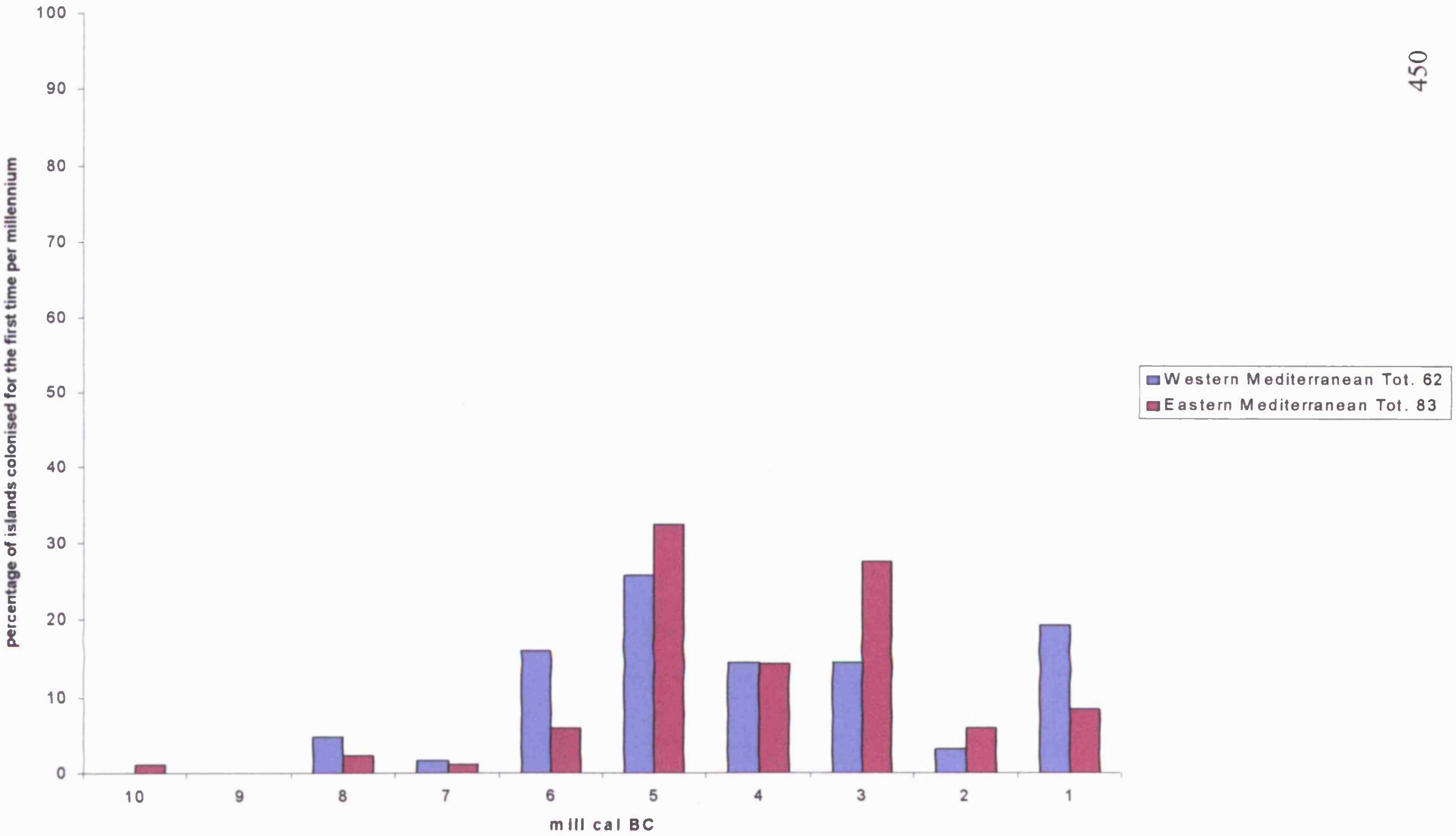


Fig. 5.8. Reworked Non-cumulative Colonisation Plot.

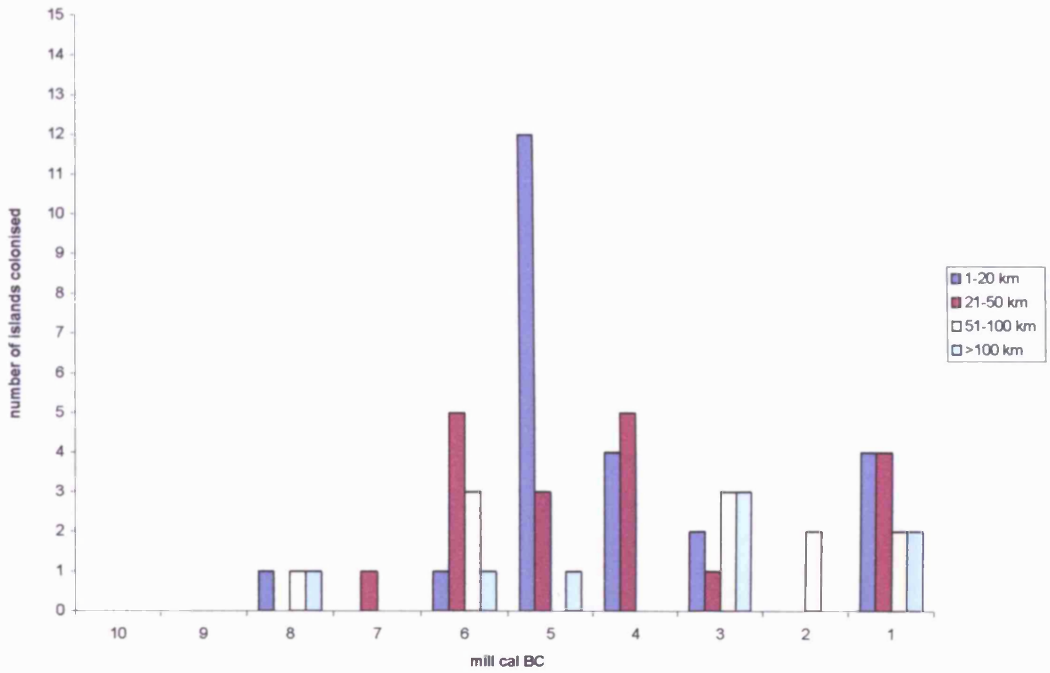


Fig. 5.9. Western Mediterranean islands divided by distance to nearest mainland and colonisation date.

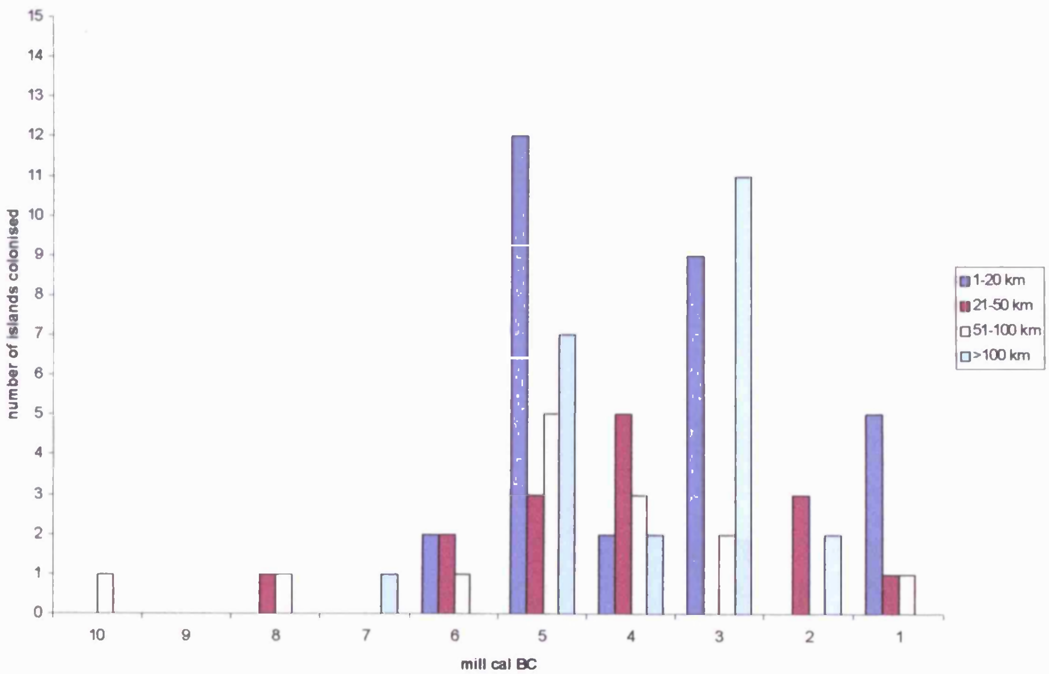


Fig. 5.10. Eastern Mediterranean islands divided by distance to nearest mainland and colonisation date.

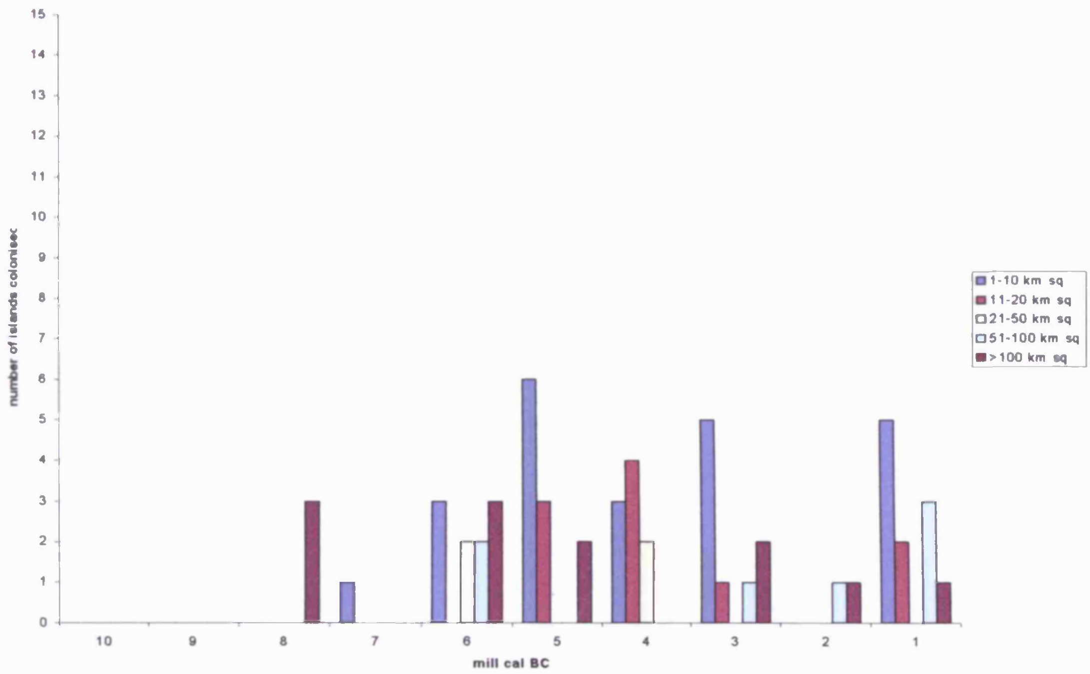


Fig. 5.11. Western Mediterranean islands divided by size and colonisation date.

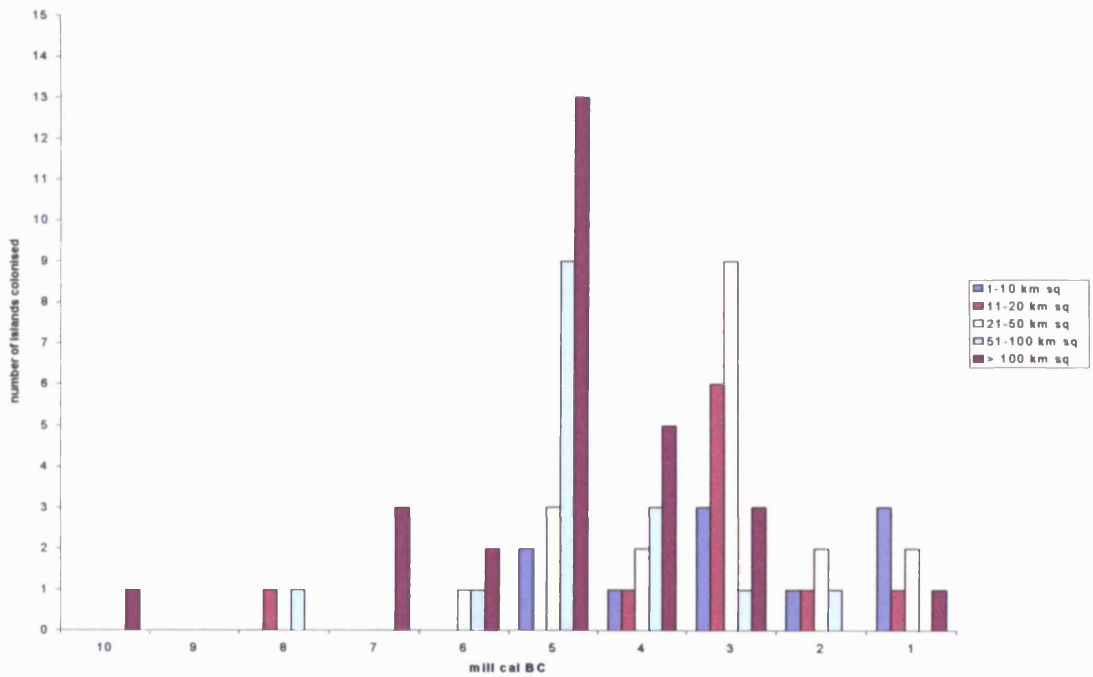


Fig. 5.12. Eastern Mediterranean islands divided by size and colonisation date.

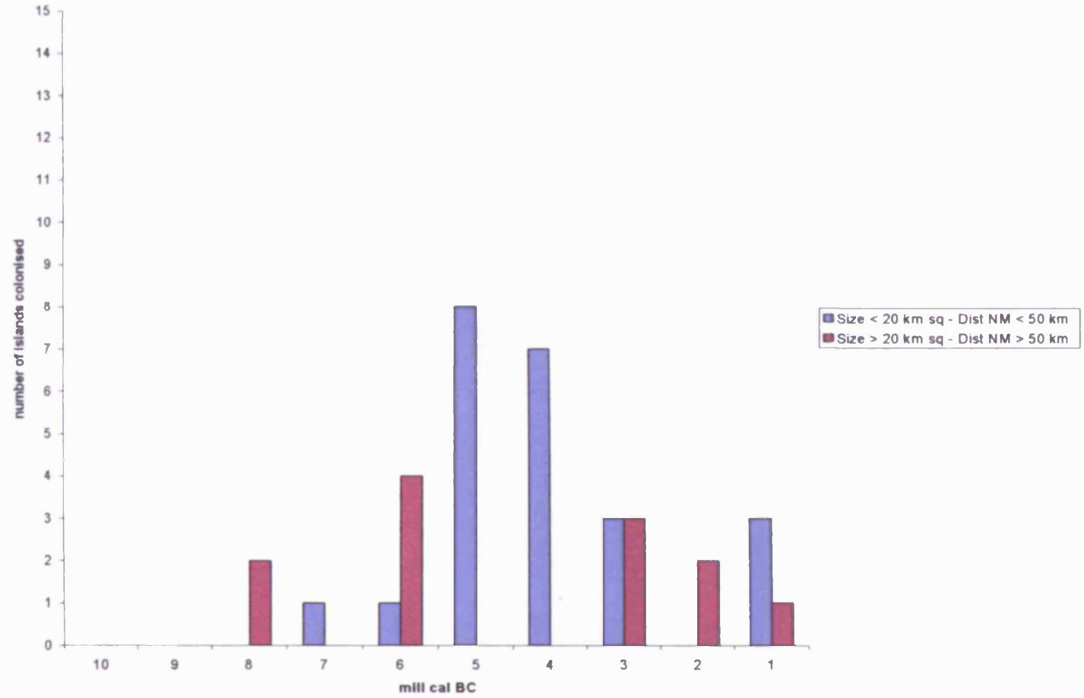


Fig. 5.13. Western Mediterranean islands colonised per millennium sorted by size and distance criteria (small and close-by vs. large and far-away).

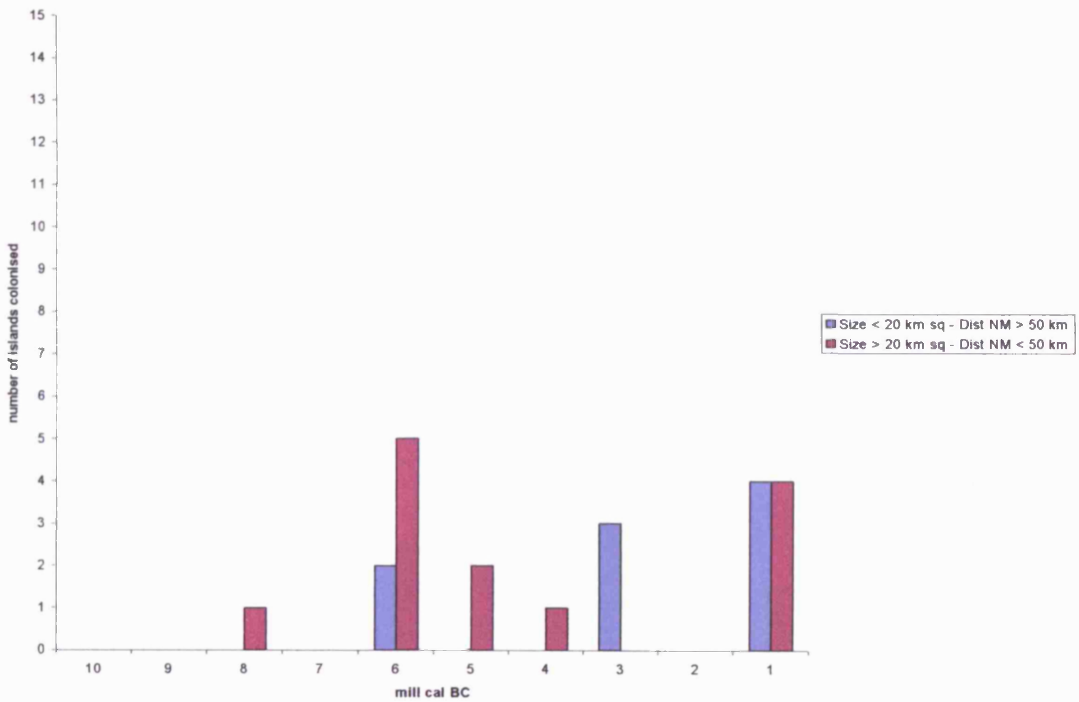


Fig. 5.14. Western Mediterranean islands colonised per millennium sorted by size and distance criteria (small and far-away vs. large and close-by).

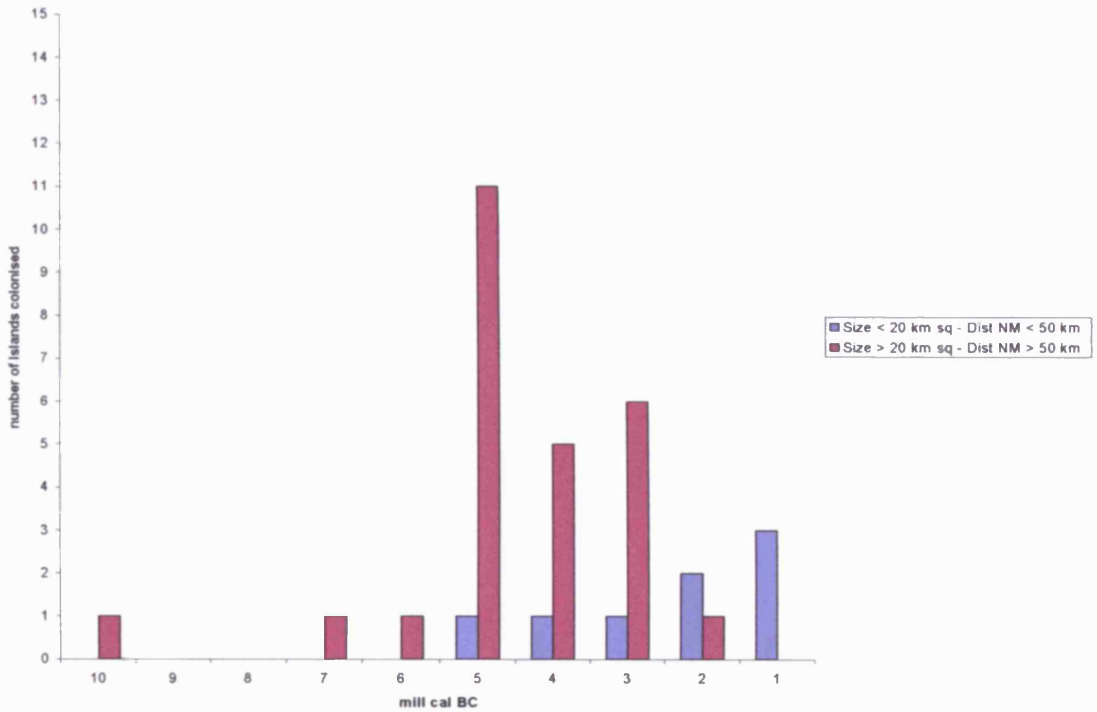


Fig. 5.15. Eastern Mediterranean islands colonised per millennium sorted by size and distance criteria (small and close-by vs. large and far-away).

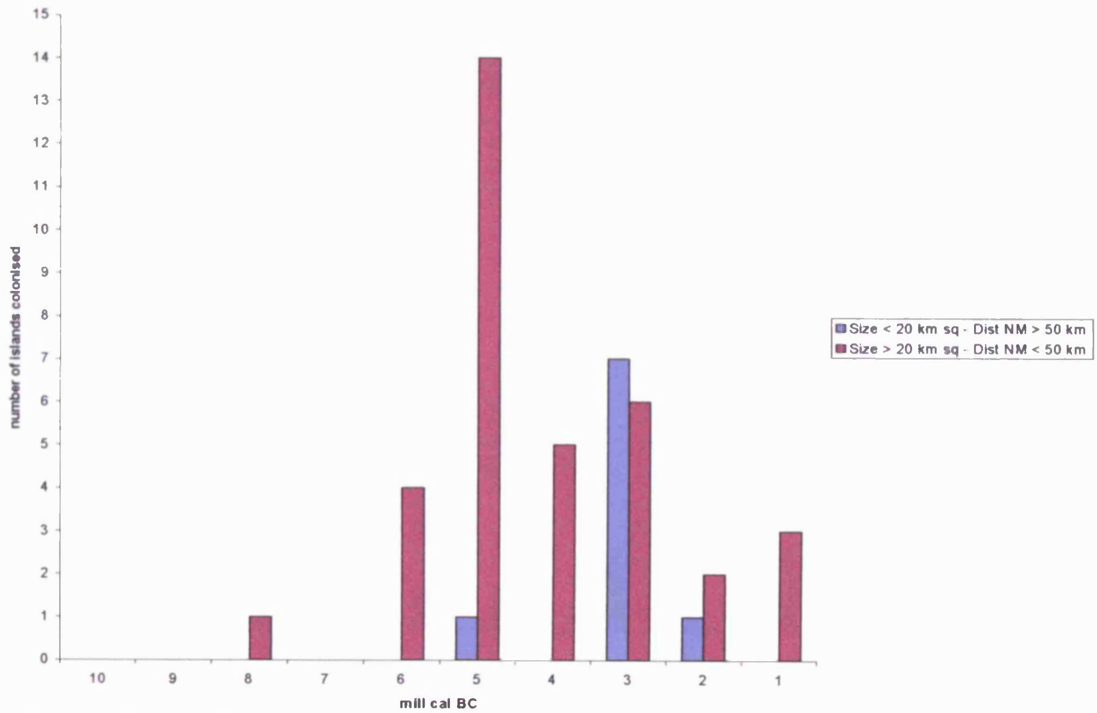


Fig. 5.16. Eastern Mediterranean islands colonised per millennium sorted by size and distance criteria (small and far-away vs. large and close-by).

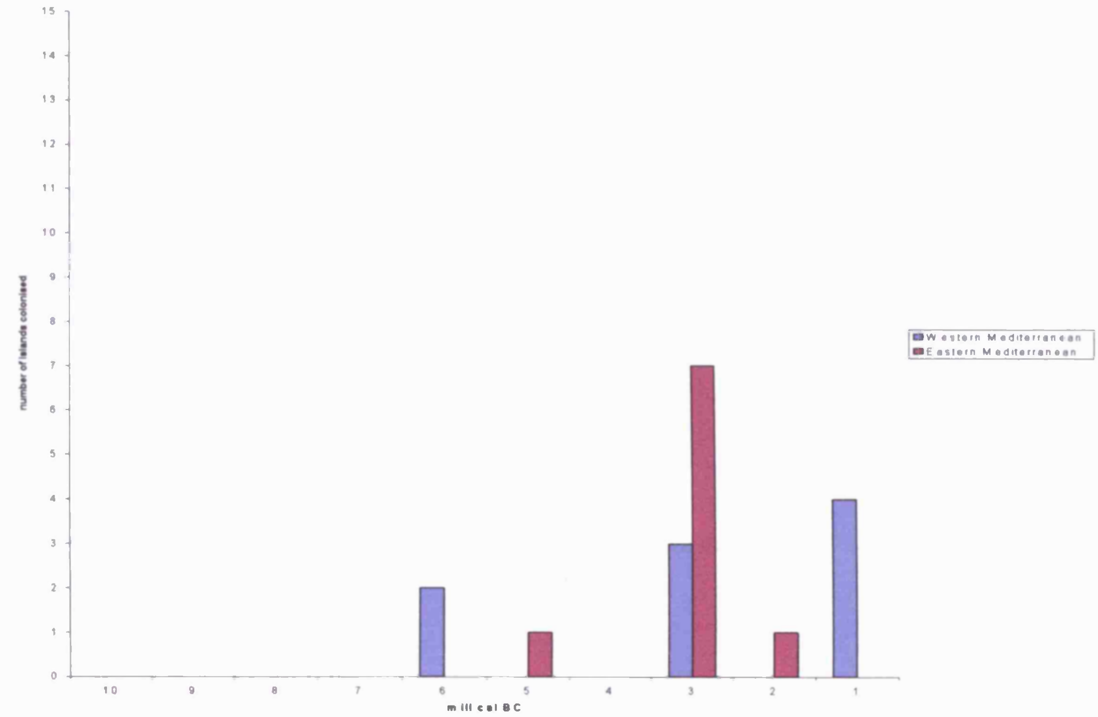


Fig. 5.17. Number of small/far-away islands (< 20 km sq and > 50 km) from nearest mainland colonised per millennium.

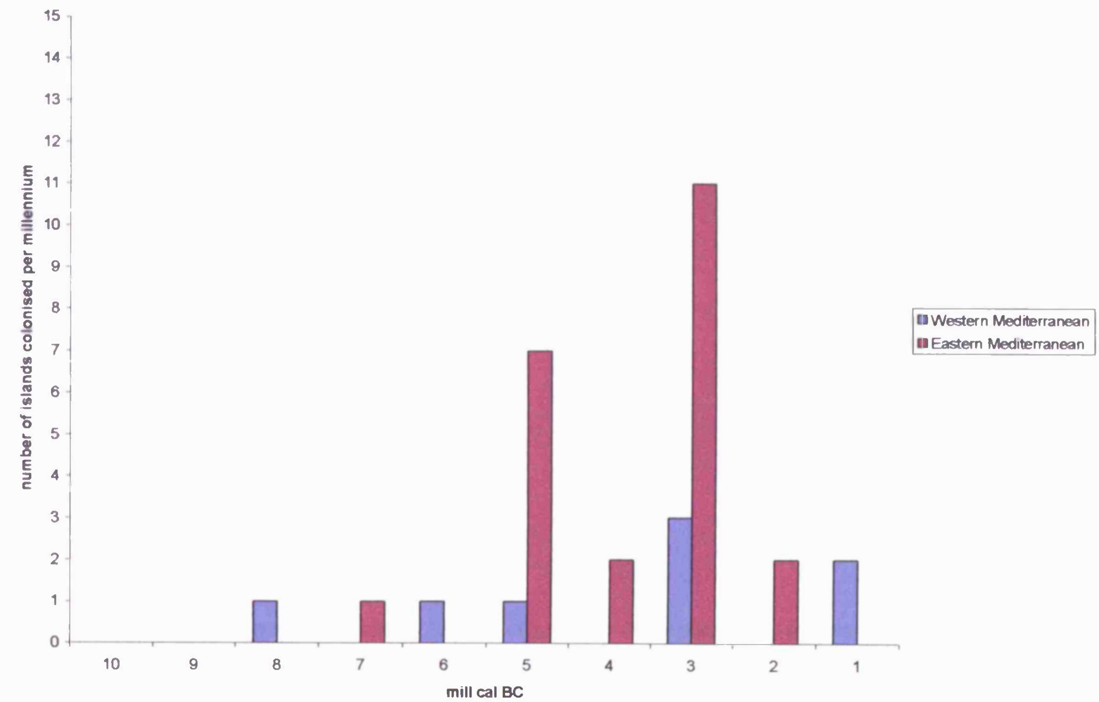


Fig. 5.18. Number of islands > 100 km from nearest mainland colonised per millennium.

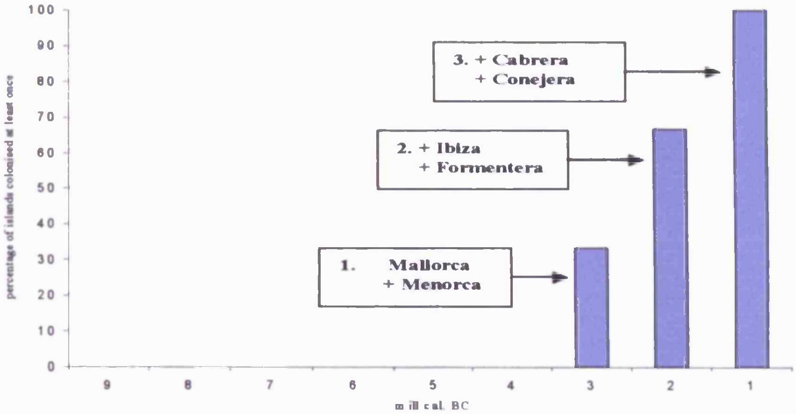


Fig. 5.19. Spanish Islands (Tot. 6). Cumulative Plot.

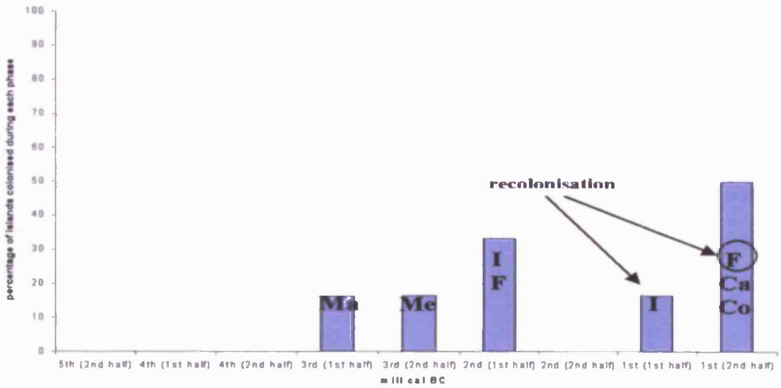


Fig. 5.20. Spanish Islands. Non-cumulative Plot.

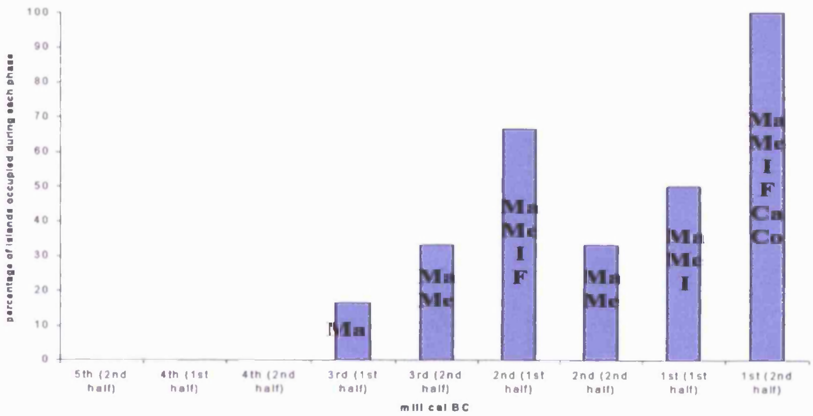


Fig. 5.21. Spanish islands. Occupation plot (includes abandonment).

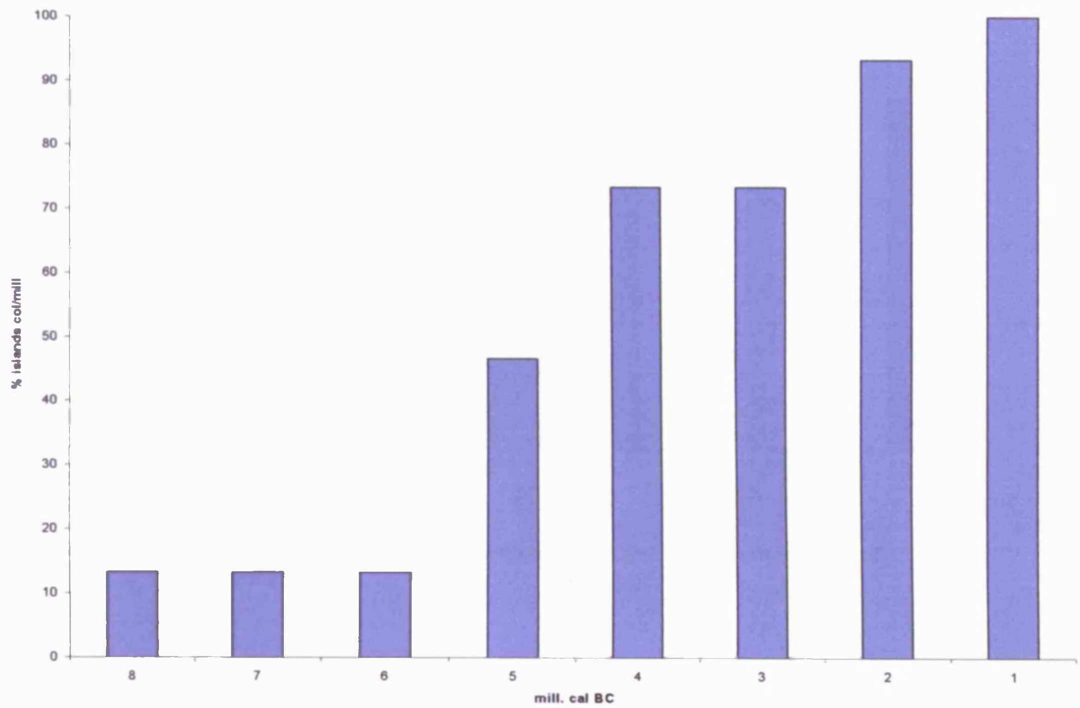


Fig. 5.22. Northern and Central Tyrrhenian Islands Tot. 12. Cumulative Plot.

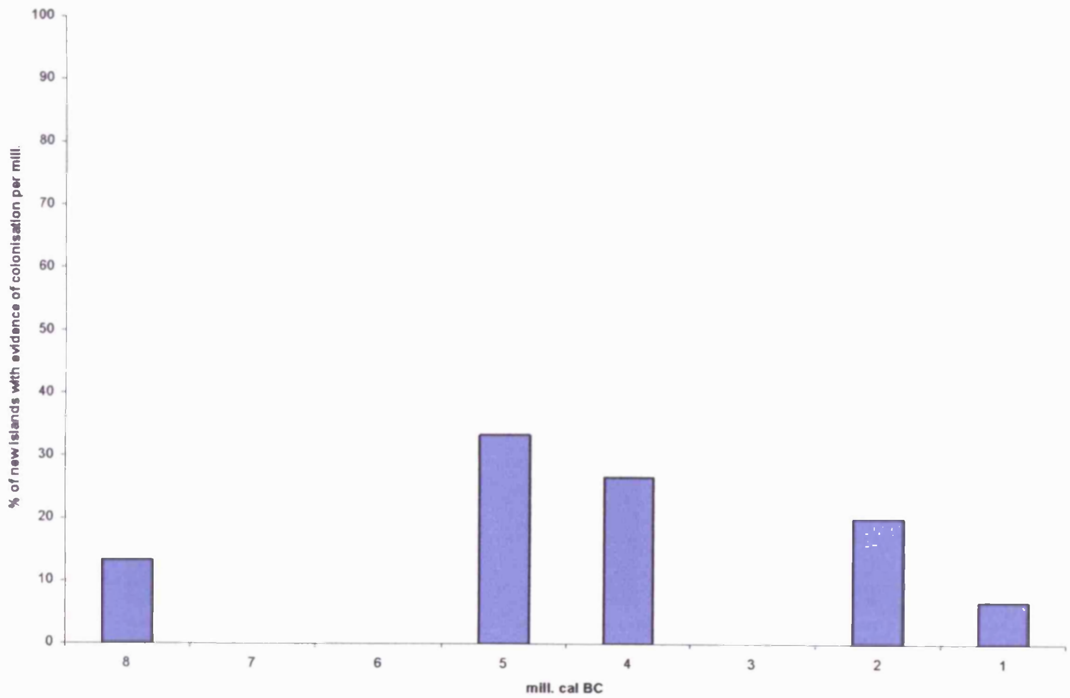


Fig. 5.23. Northern and Central Tyrrhenian Islands. Non-cumulative Plot (rates of colonisation per millennium).

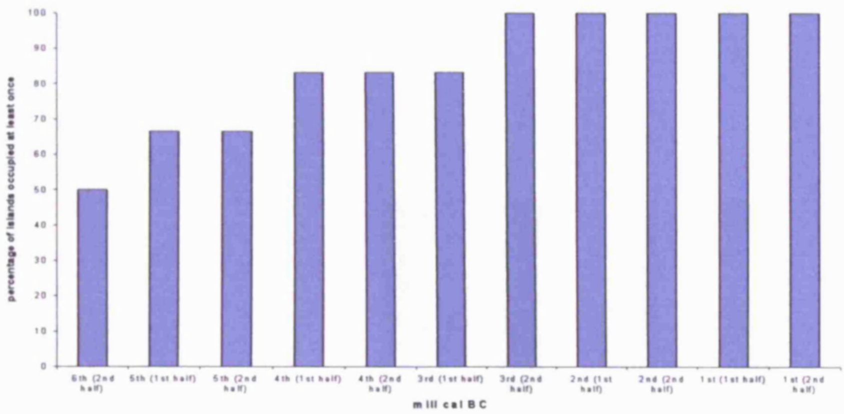


Fig. 5.24. Southern Tyrrhenian: Aeolian Islands Tot. 6 (Vulcano is excluded). Cumulative Plot.

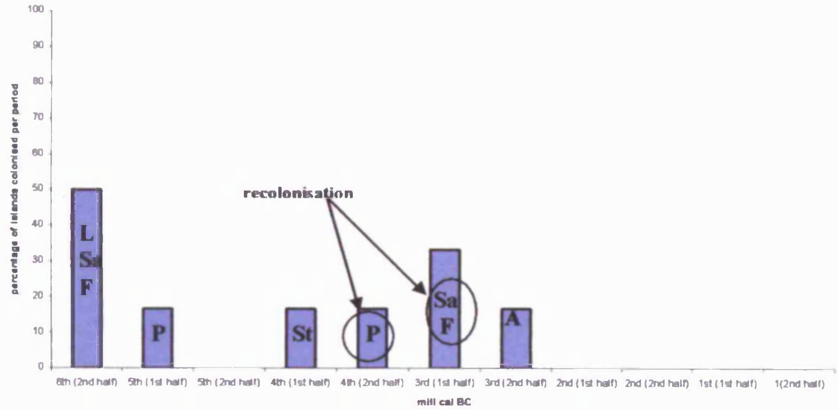


Fig. 5.25. Southern Tyrrhenian: Aeolian Islands. Non-cumulative Plot.

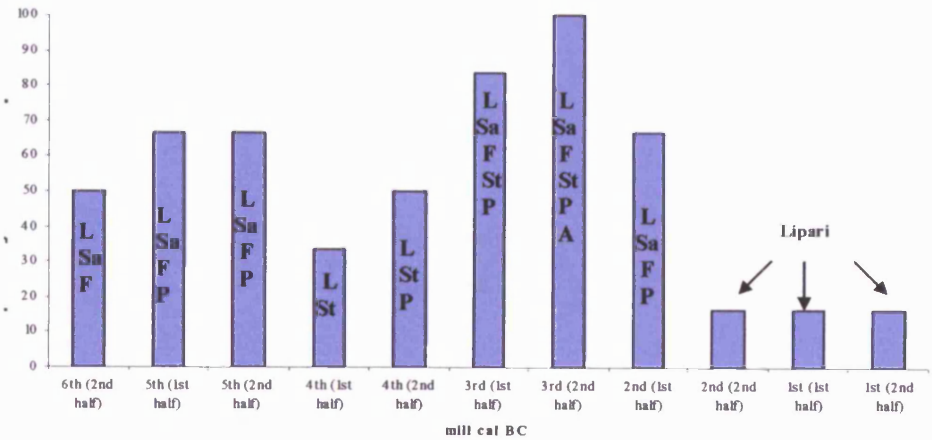


Fig. 5.26. Southern Tyrrhenian: Aeolian Islands. Occupation Plot (shows abandonment).

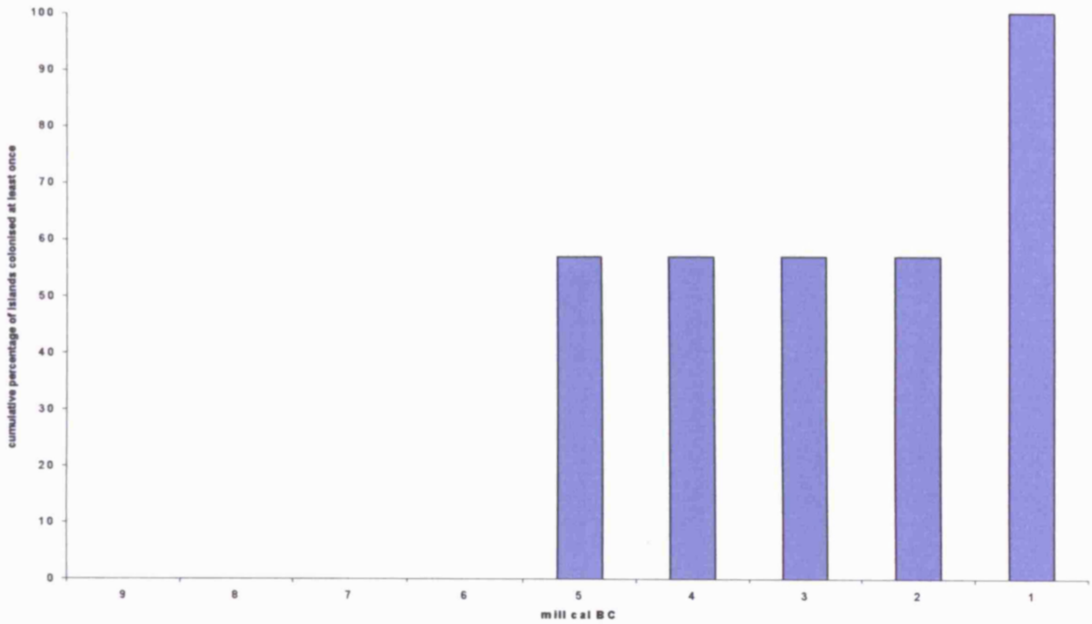


Fig. 5.27. North African Islands Tot. 14. Cumulative Plot.

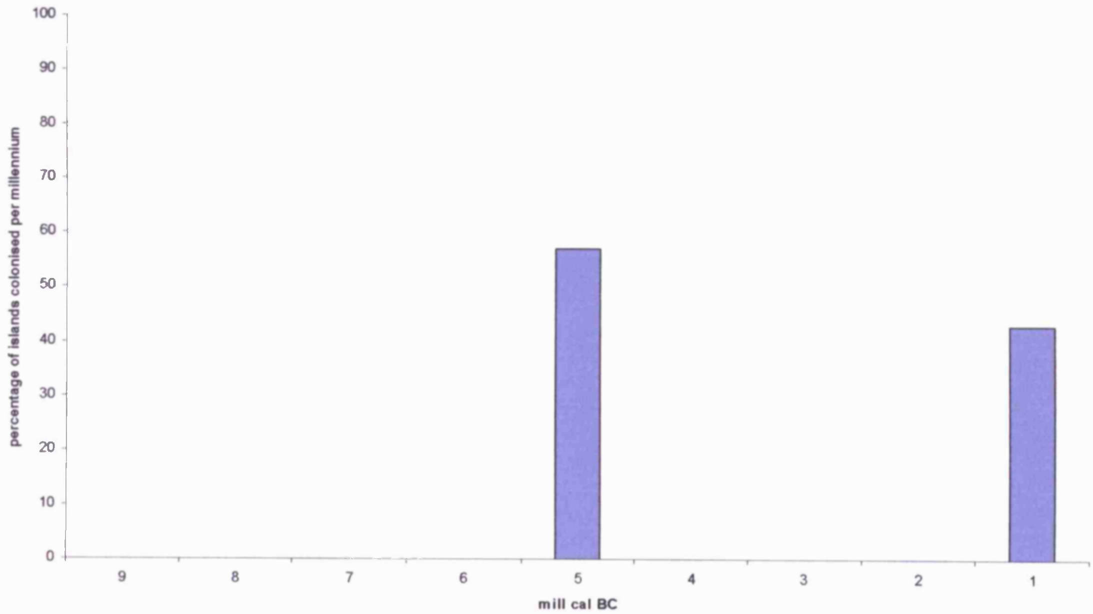


Fig. 5.28. North African Islands. Non-cumulative Plot (rates of colonisation per millennium).

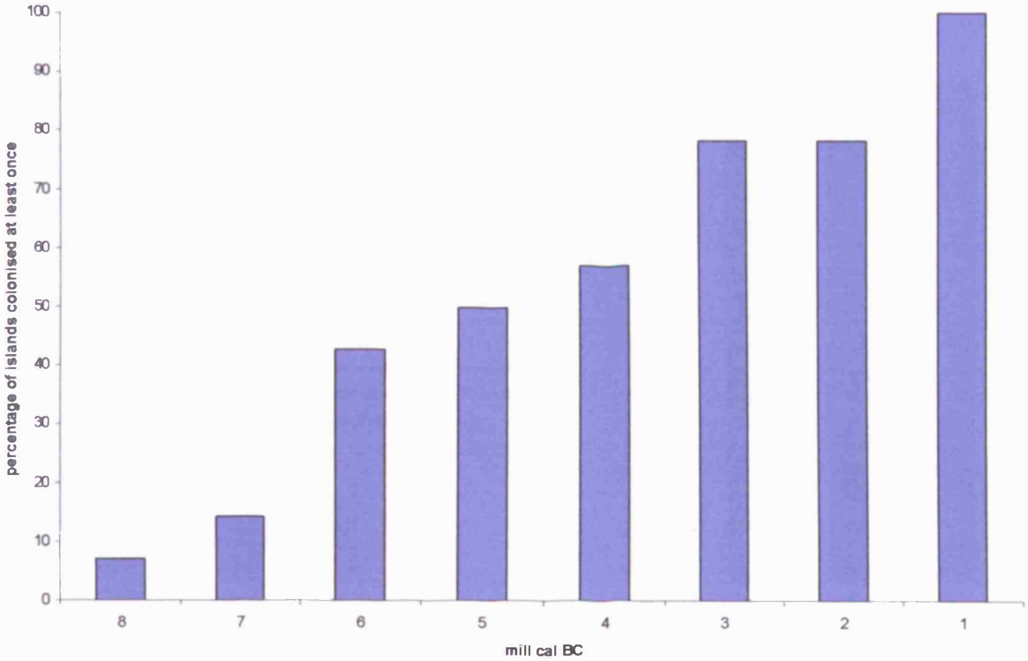


Fig. 5.29. Dalmatian (East-Central Adriatic) Islands Tot. 14. Cumulative Plot

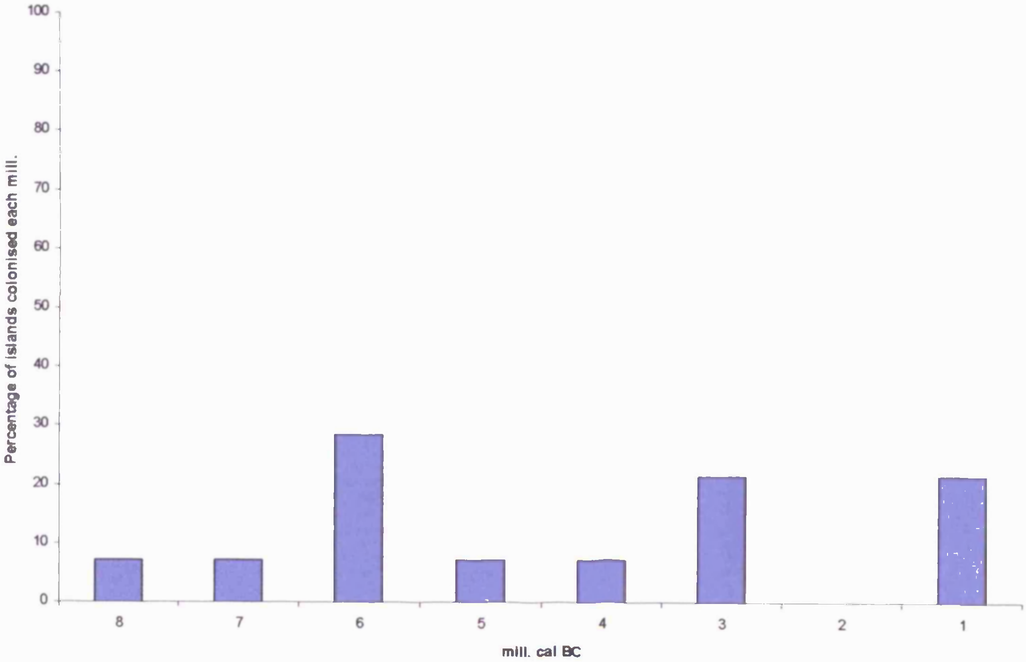


Fig. 5.30. Dalmatian (East-Central Adriatic) Islands. Non-cumulative Plot (rates of colonisation per millennium).

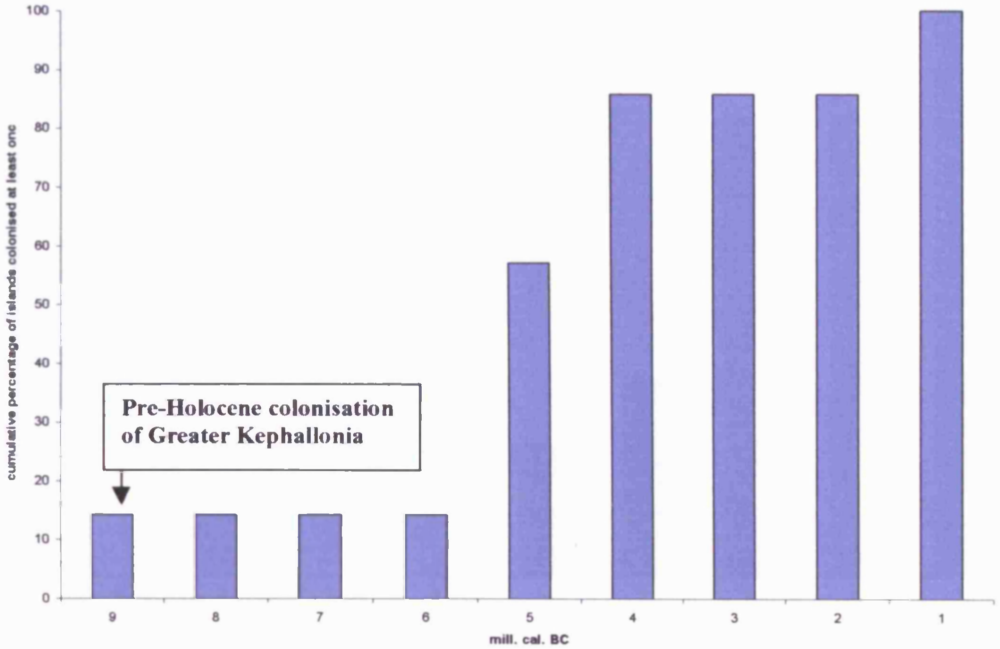


Fig. 5.31. Ionian Islands Tot. 7. Cumulative Plot.

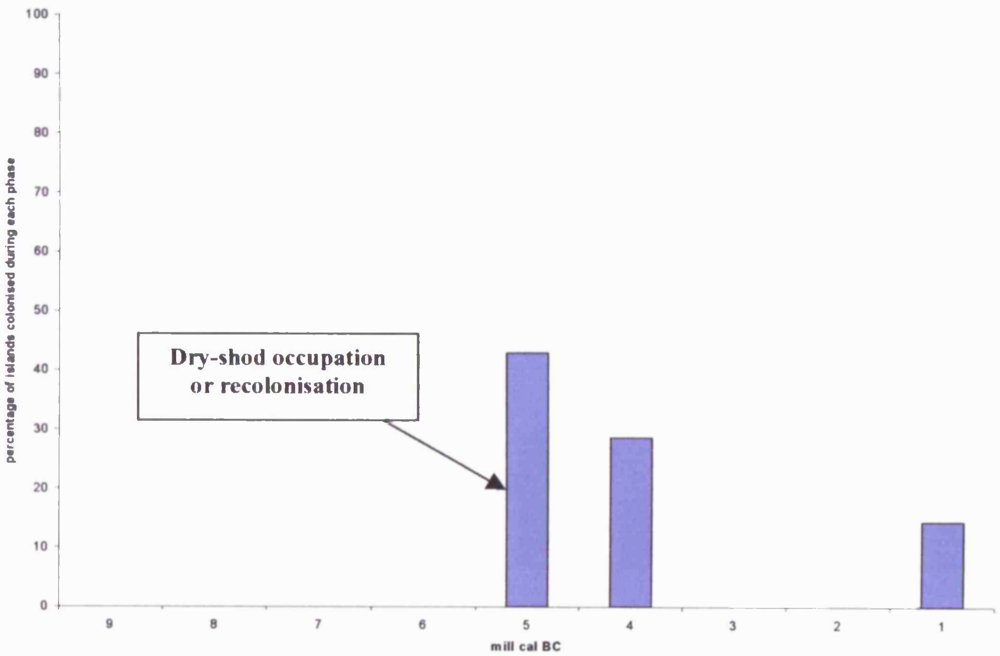


Fig. 5.32. Ionian Islands. Non-cumulative Plot (rates of colonisation per millennium).

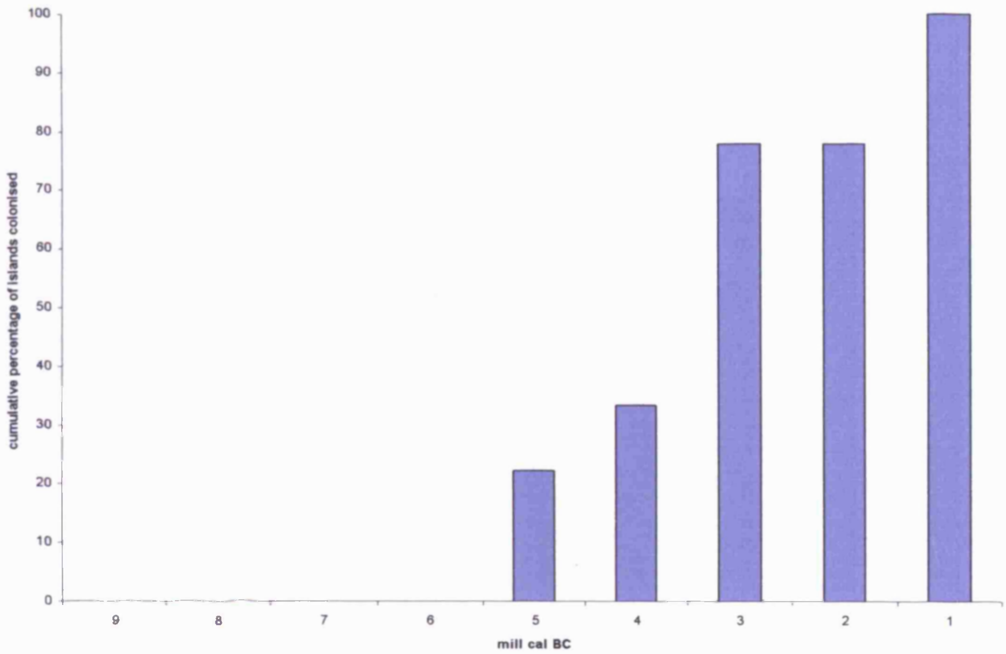


Fig. 5.33. SW Aegean Tot. 9. Cumulative Plot.

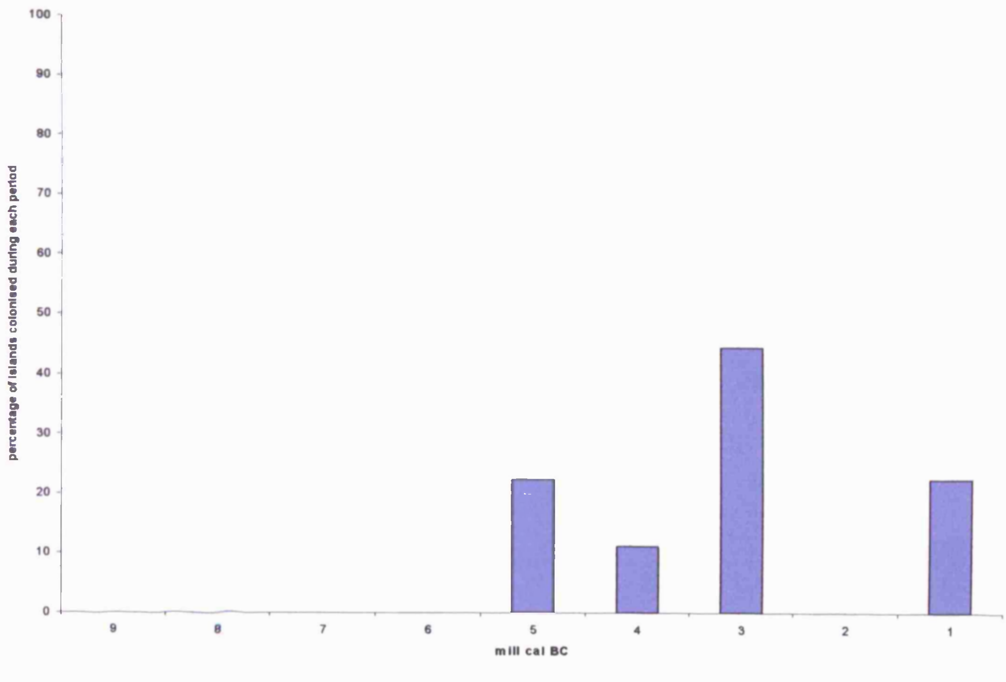


Fig. 5.34. SW Aegean. Non-cumulative Plot (rates of colonisation per millennium).

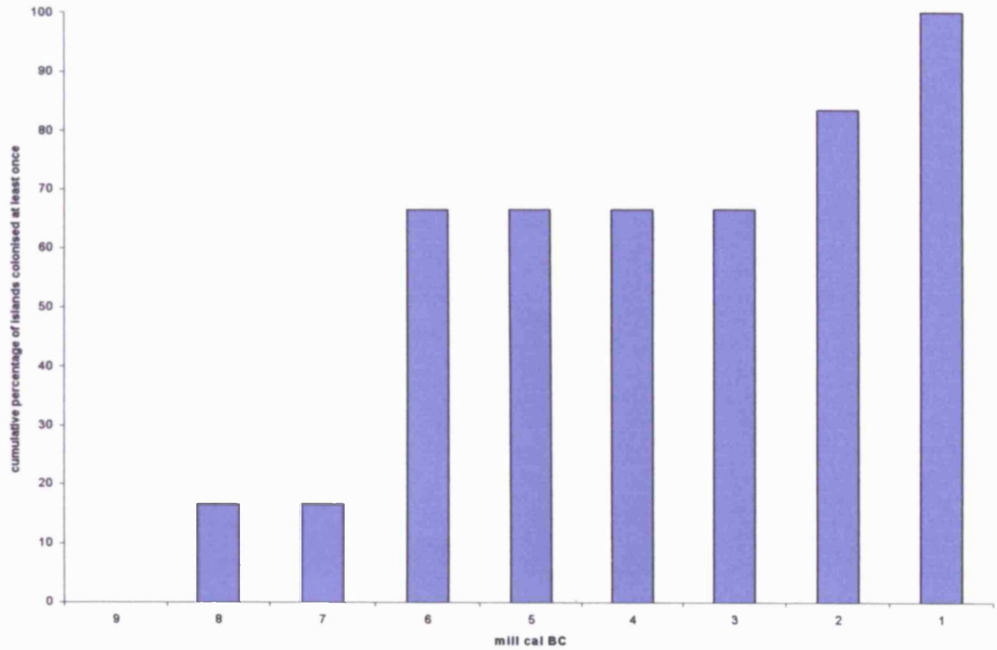


Fig. 5.35. Northern Sporadhes Tot. 6. Cumulative Plot.

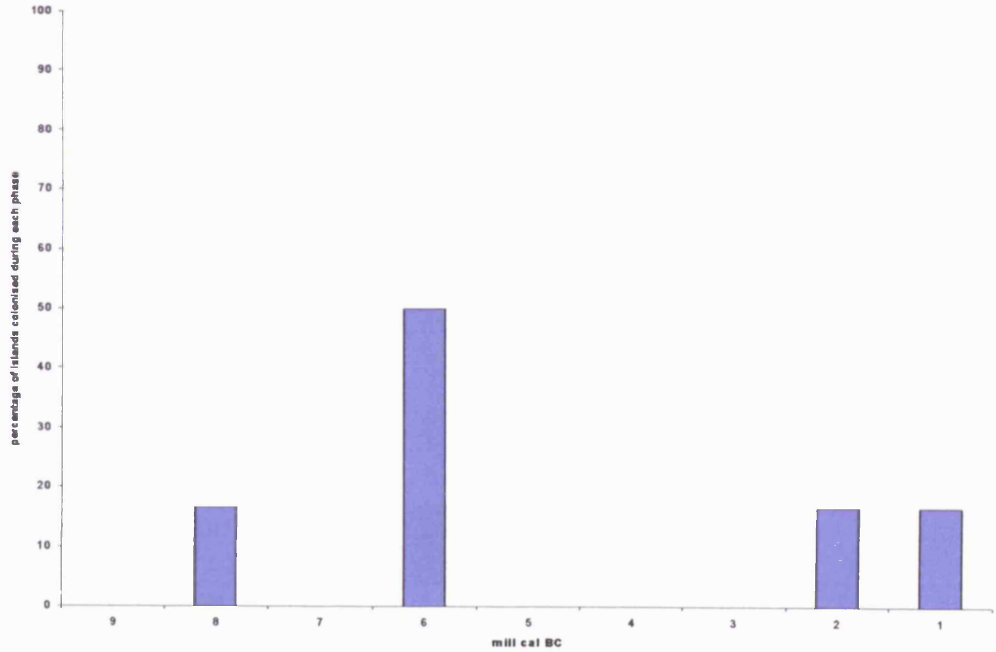


Fig. 5.36. Northern Sporadhes. Non-cumulative Plot (rates of colonisation per millennium).

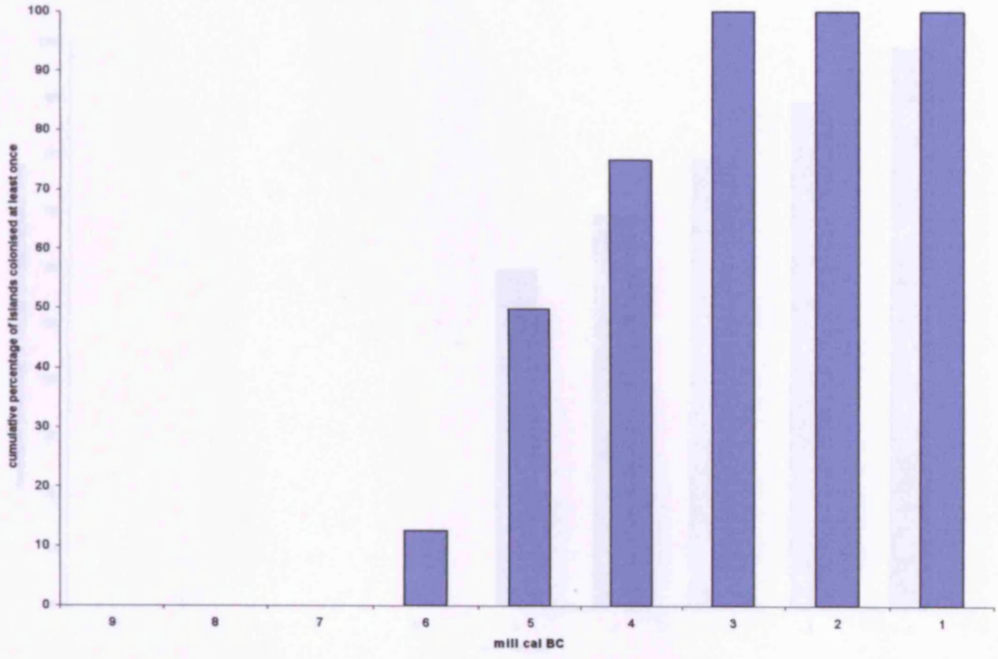


Fig. 5.37. NE Aegean Tot. 8. Cumulative Plot.

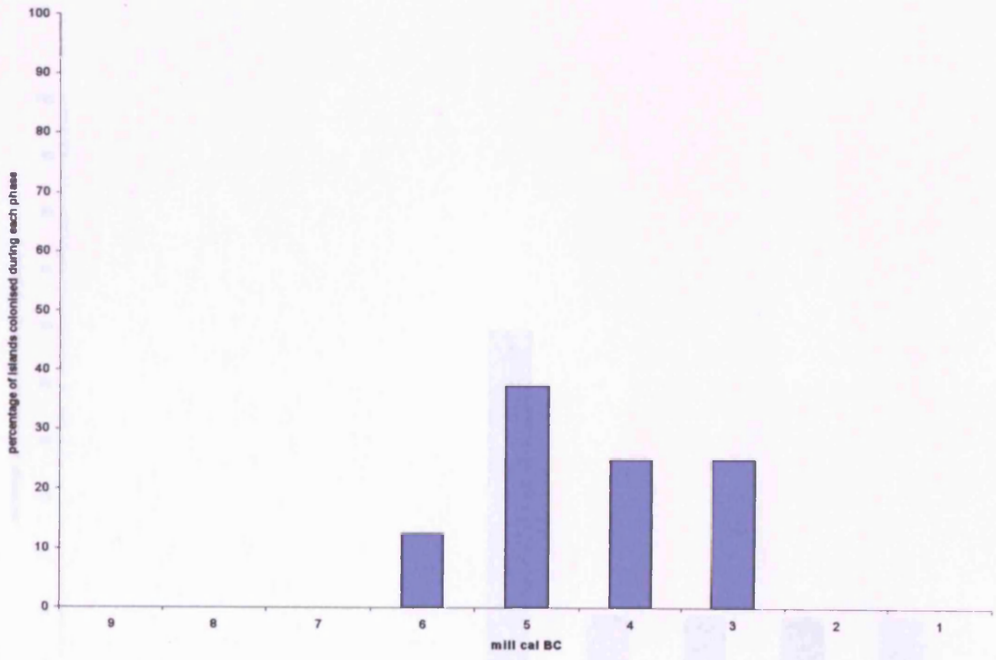


Fig. 5.38. NE Aegean. Non-cumulative Plot (rates of colonisation per millennium).

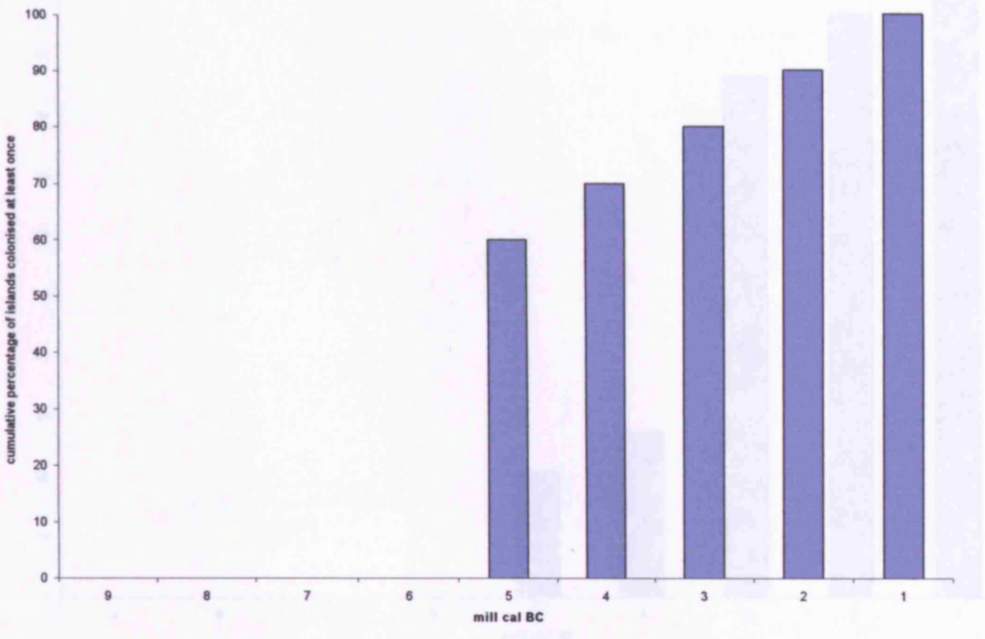


Fig. 5.39. SE Aegean Tot. 20. Cumulative Plot.

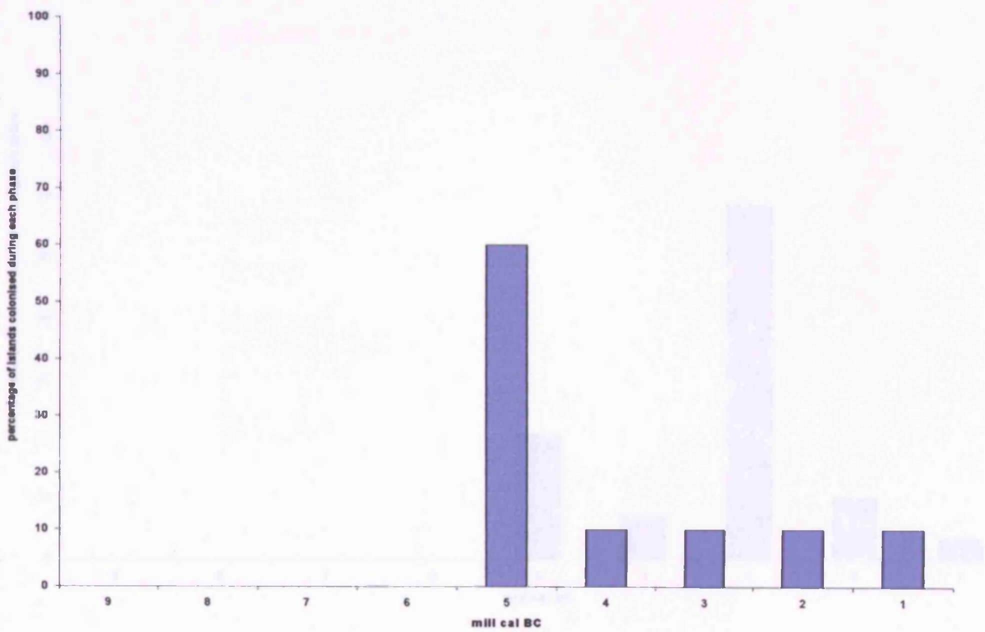


Fig. 5.40. SE Aegean. Non-cumulative Plot (rates of colonisation per millennium).

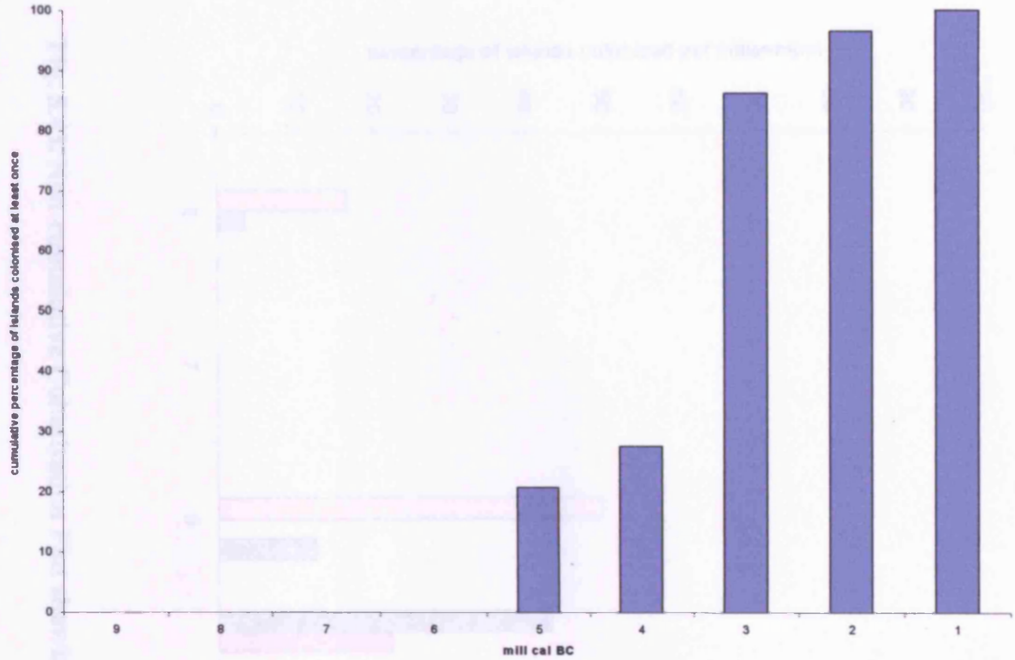


Fig. 5.41. Cyclades Tot. 28. Cumulative Plot.

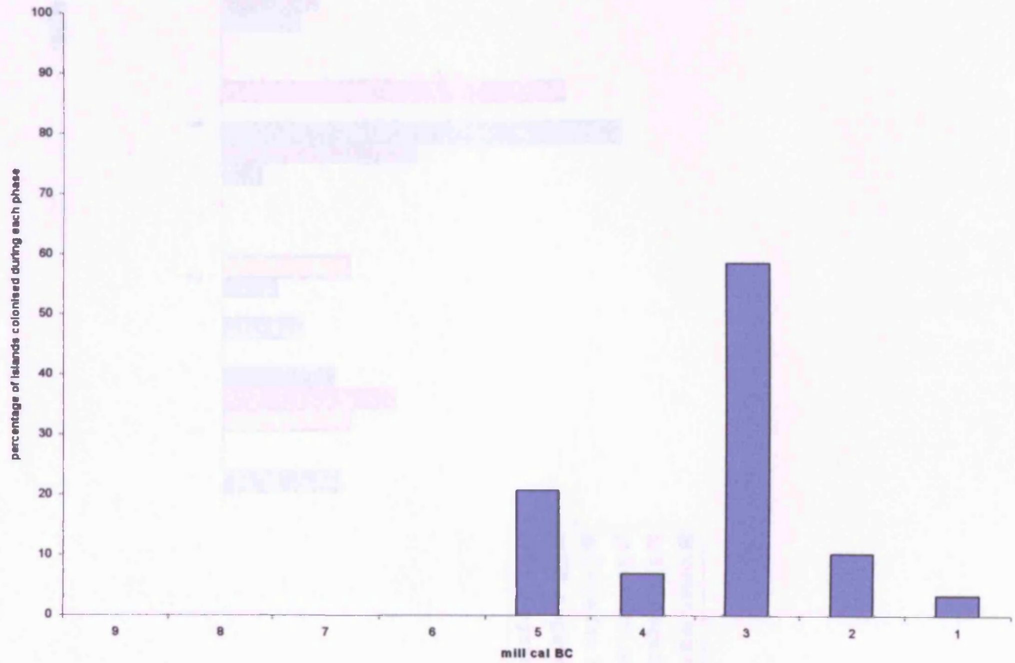


Fig. 5.42. Cyclades. Non-cumulative Plot (rates of colonisation per millennium).

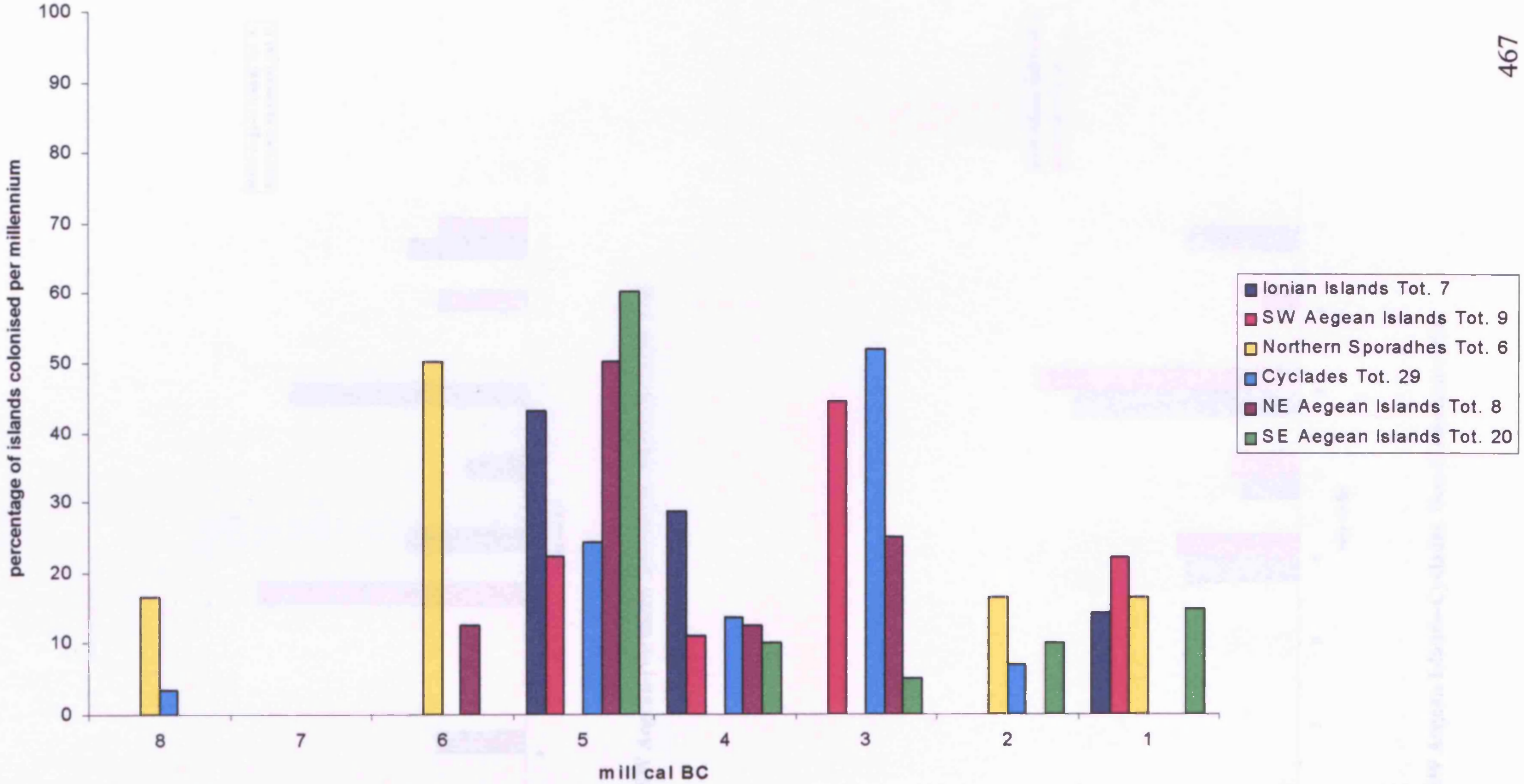


Fig. 5.43. Non-cumulative Colonisation Plot showing six island groups.

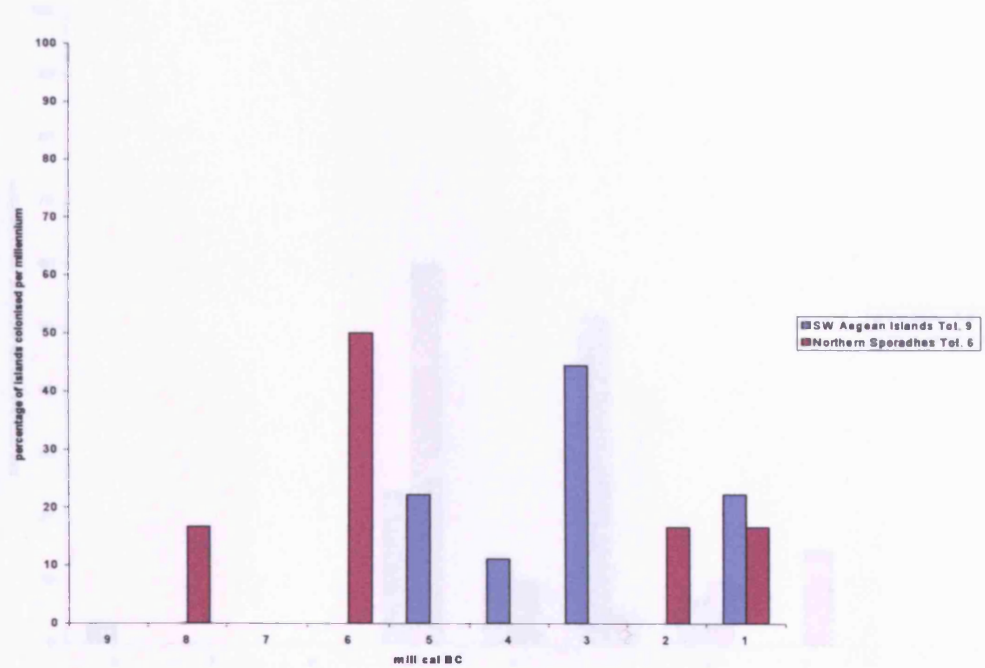


Fig. 5.44. SW Aegean-Northern Sporadhes. Non-cumulative Plot

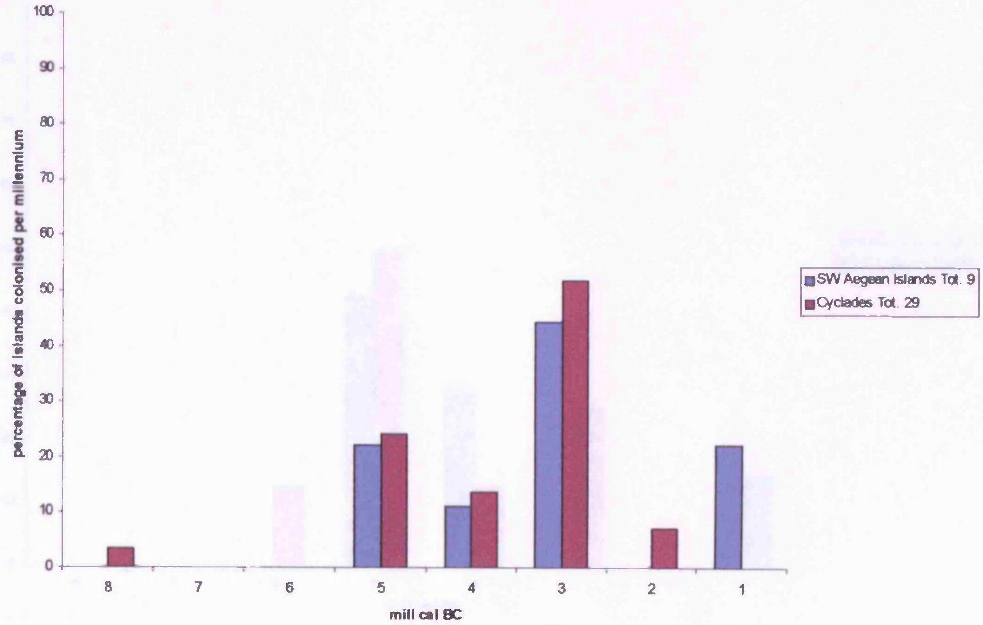


Fig. 5.45. SW Aegean Islands-Cyclades. Non-Cumulative Plot.

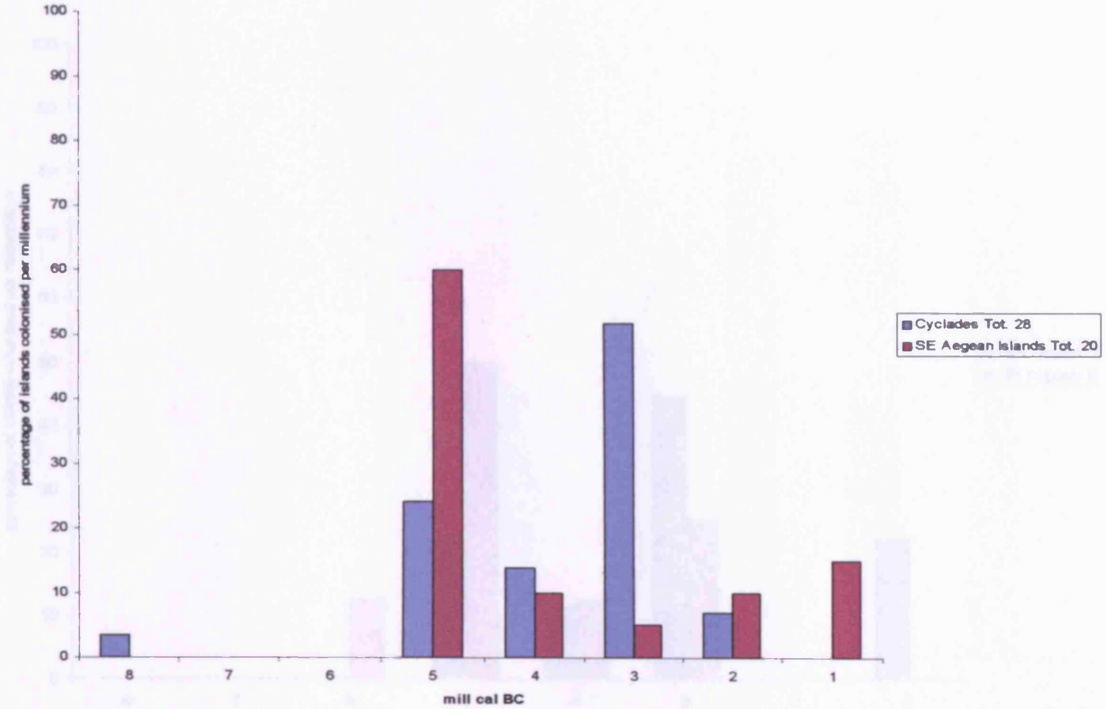


Fig. 5.46. Cyclades-SE Aegean. Non-Cumulative Plot

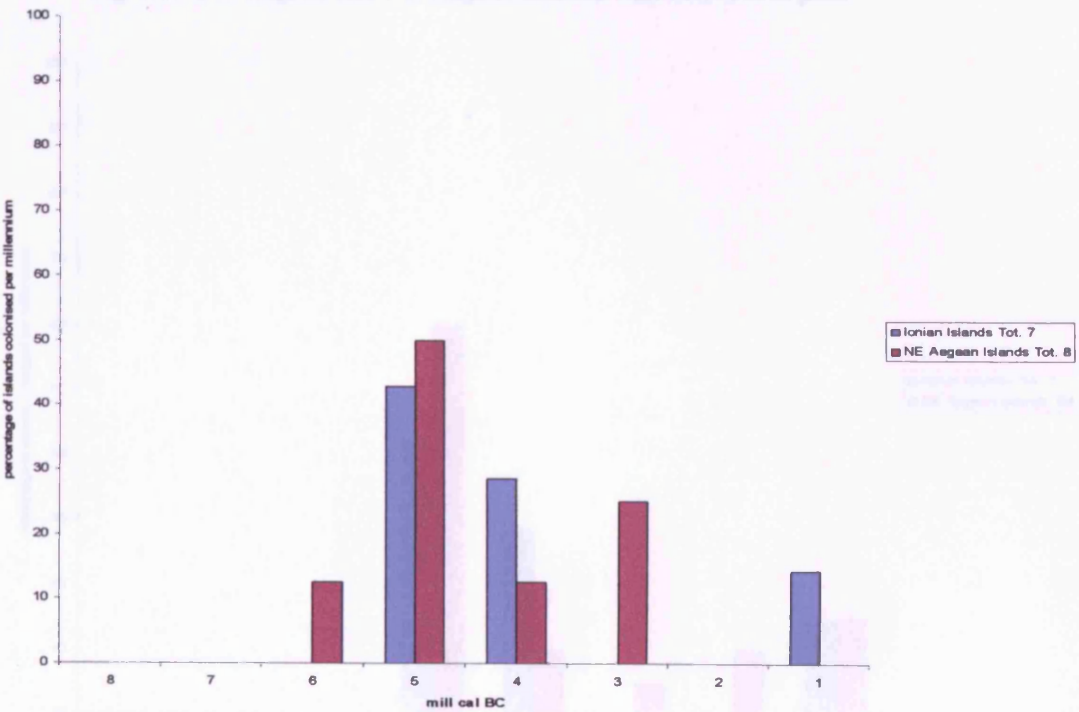


Fig. 5.47. Ionian-NE Aegean. Non-cumulative Plot

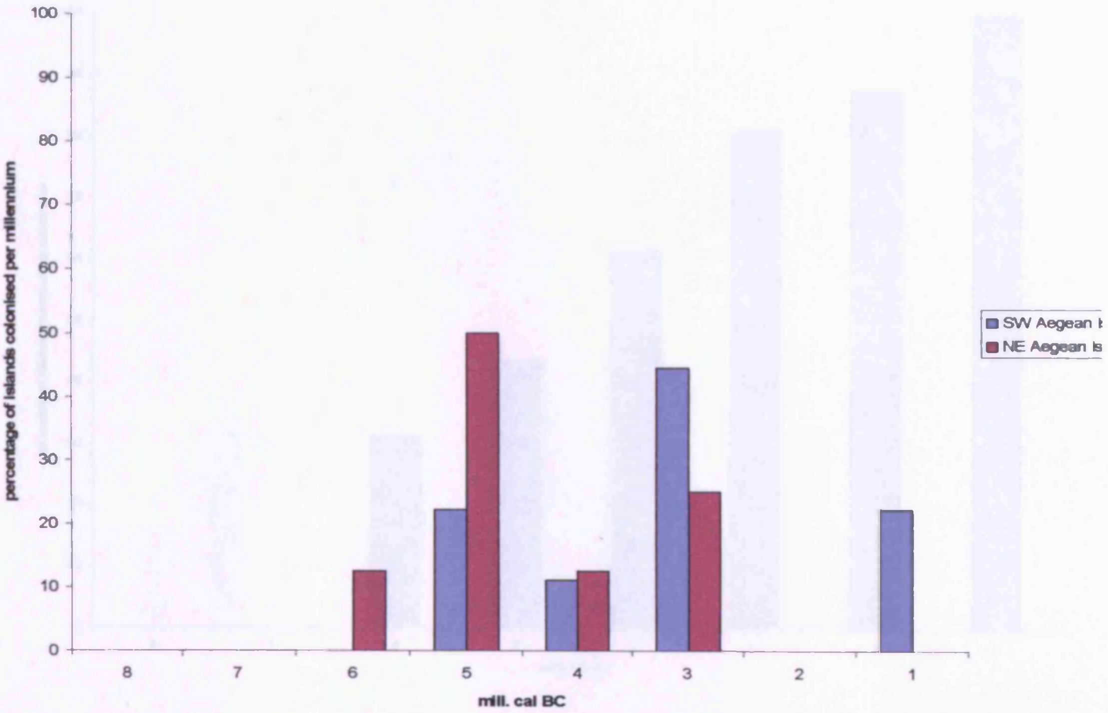


Fig. 5.48. SW Aegean and NE Aegean Islands. Non-cumulative plot.

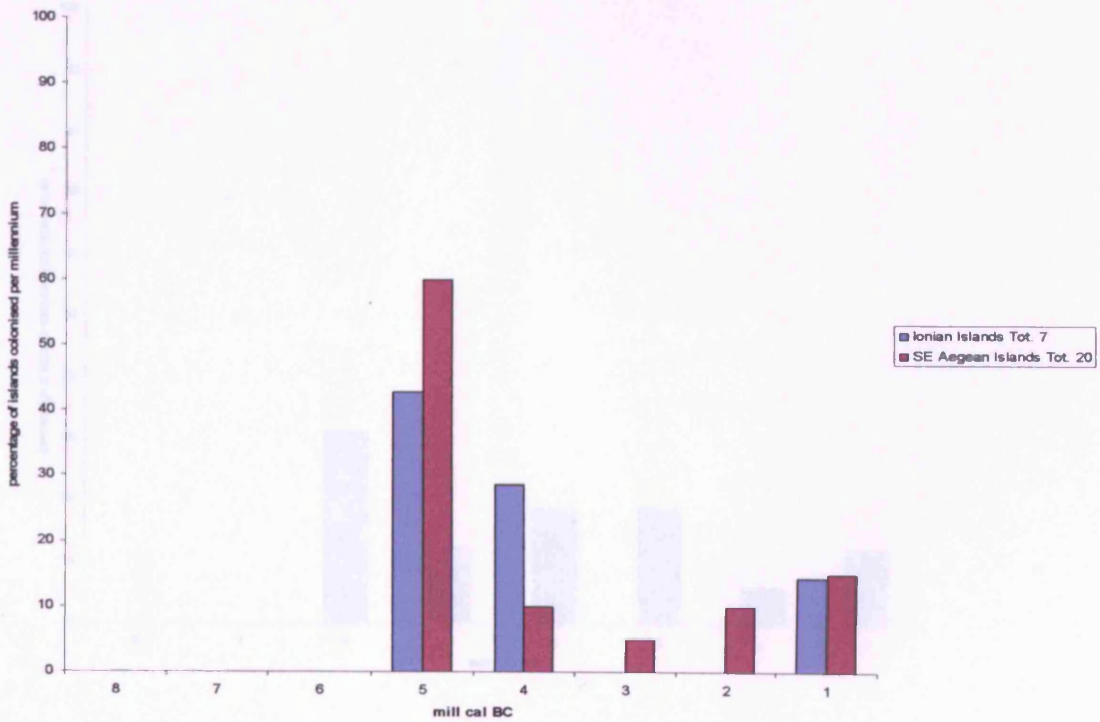


Fig. 5.49. Ionian and SE Aegean Islands. Non-cumulative plot

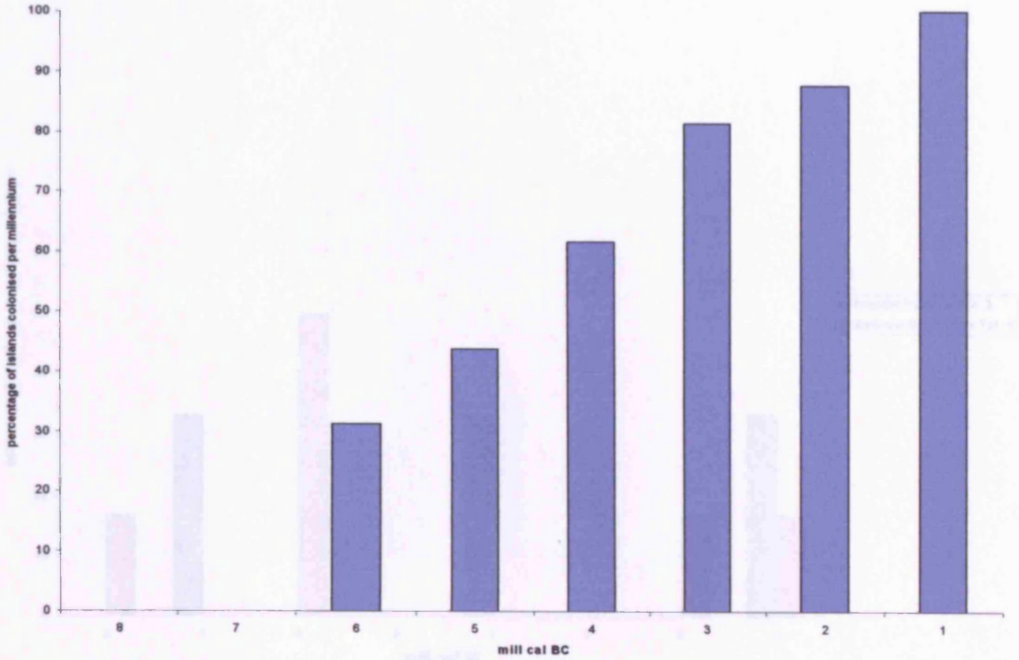


Fig. 5.50. Islands off Sicily (including Malta) – Cumulative Plot.

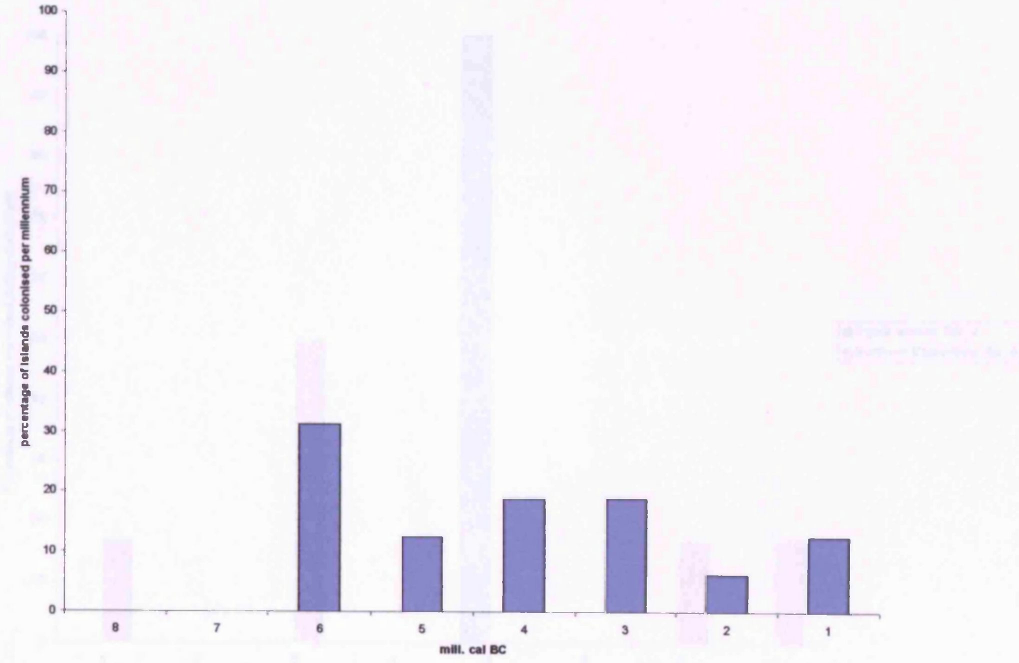


Fig. 5.51. Islands off Sicily. Non-cumulative Plot (rates of colonisation per millennium).

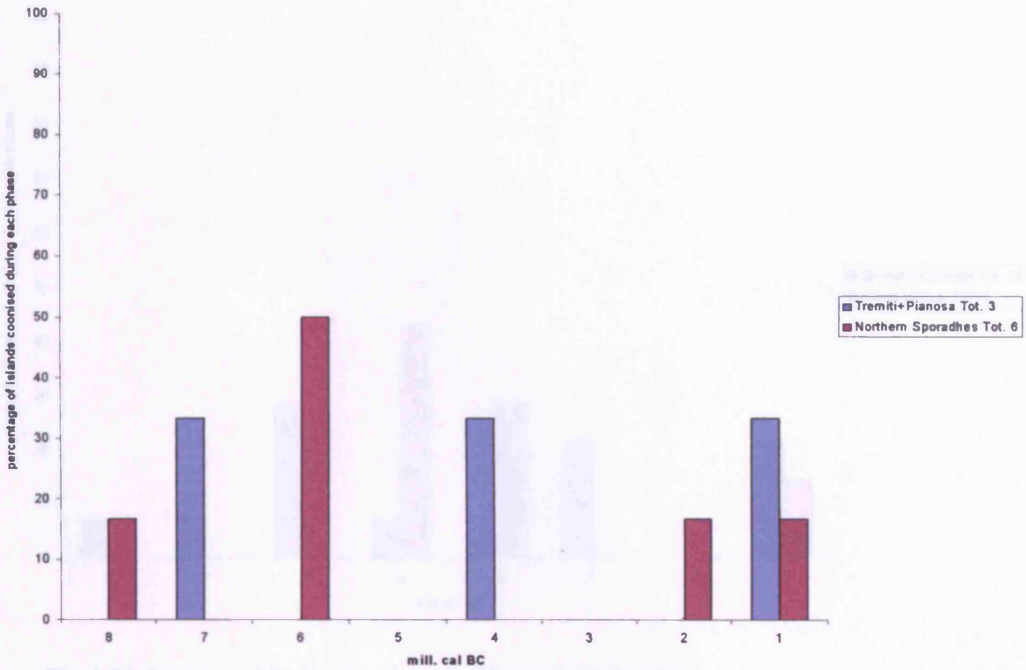


Fig. 5.52. Northern Sporadhes and Tremiti+Pianosa. Non-cumulative Plot.

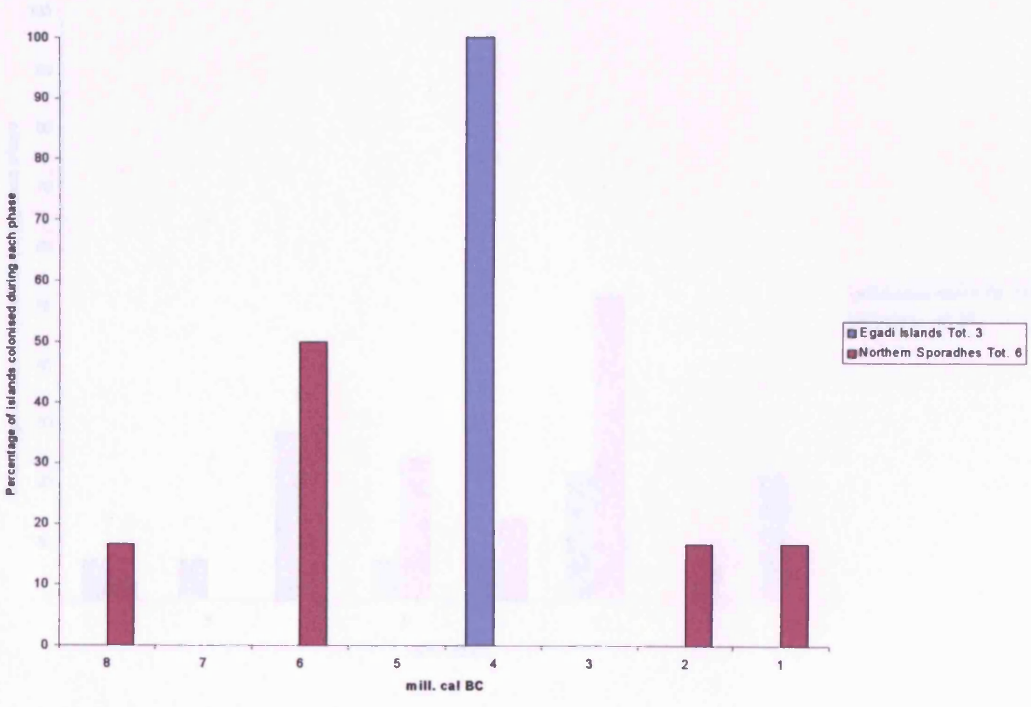


Fig. 5.53. Egadi Islands and Northern Sporadhes. Non-cumulative Plot.

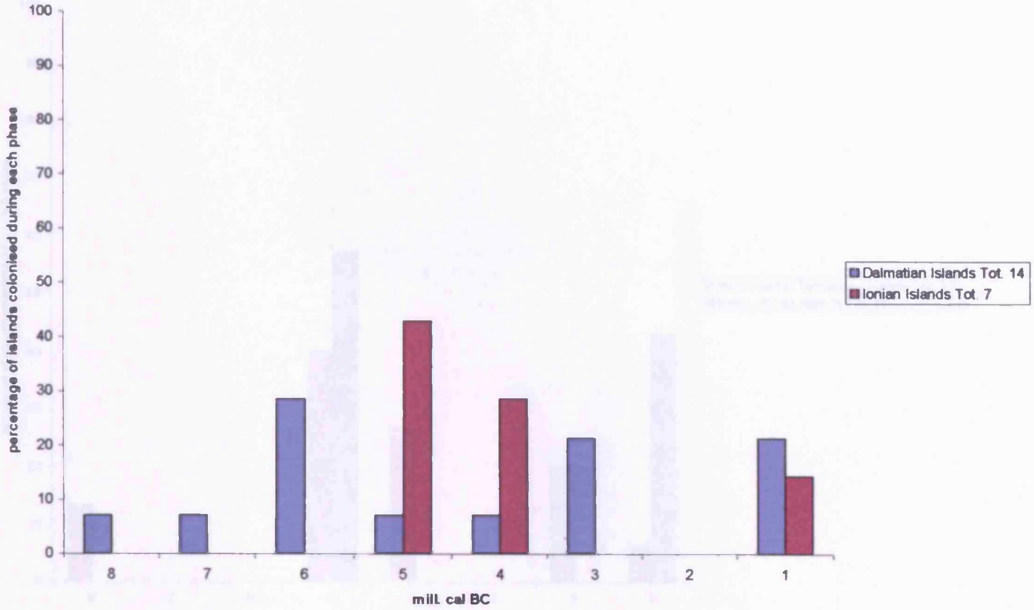


Fig. 5.54. Ionian and Dalmatian Islands. Non-cumulative Plot.

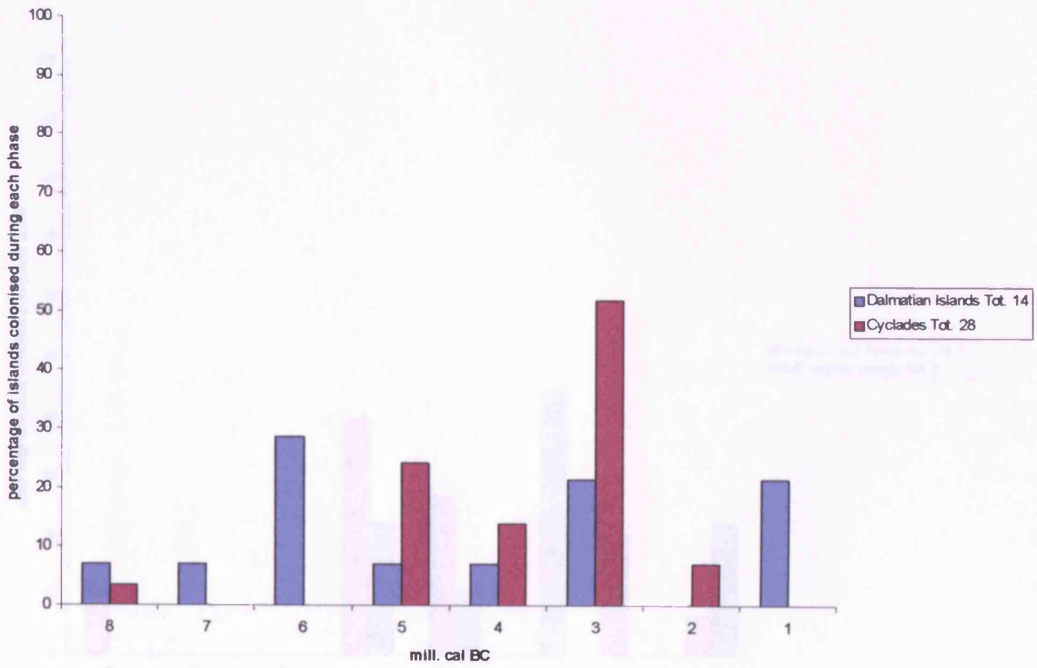


Fig. 5.55. Cyclades and Dalmatian Islands. Non-cumulative plot.

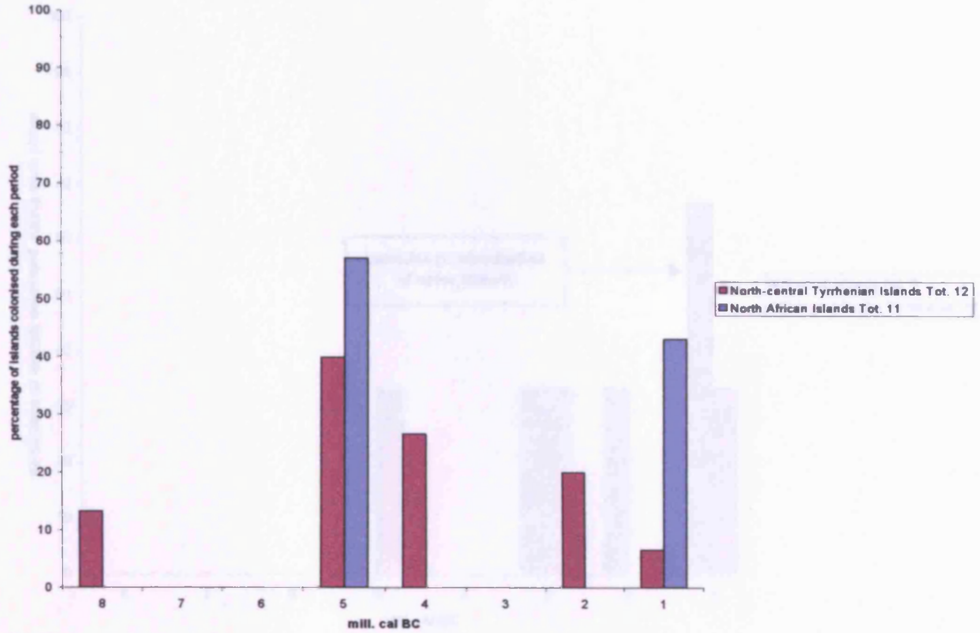


Fig. 5.56. Northern-central Tyrrhenian and North African Islands. Non-cumulative plot.

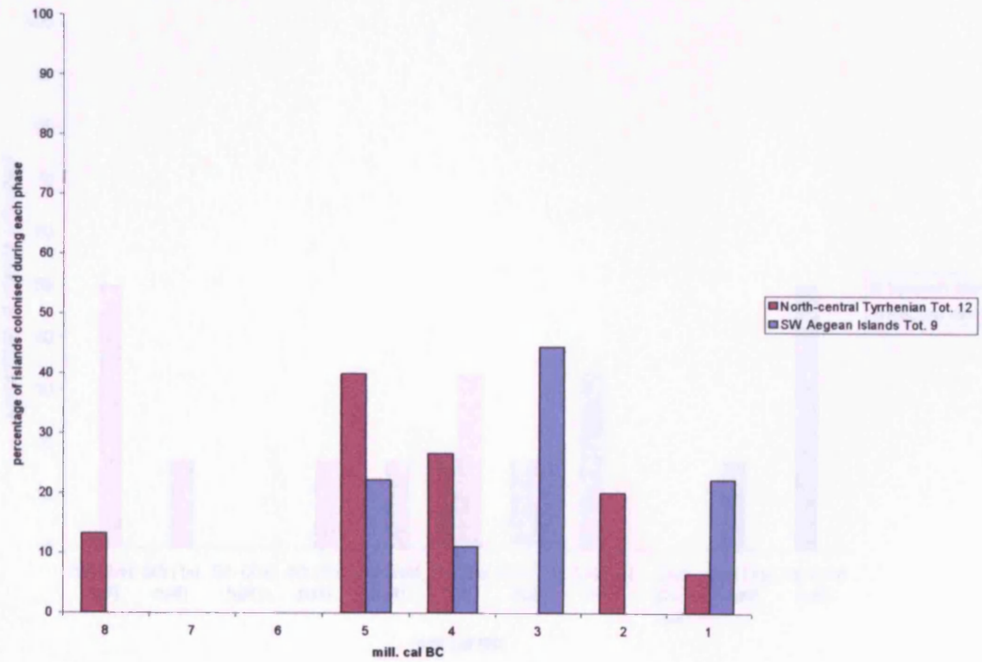


Fig. 5.57. North-central Tyrrhenian and SW Aegean Islands. Non-cumulative plot.

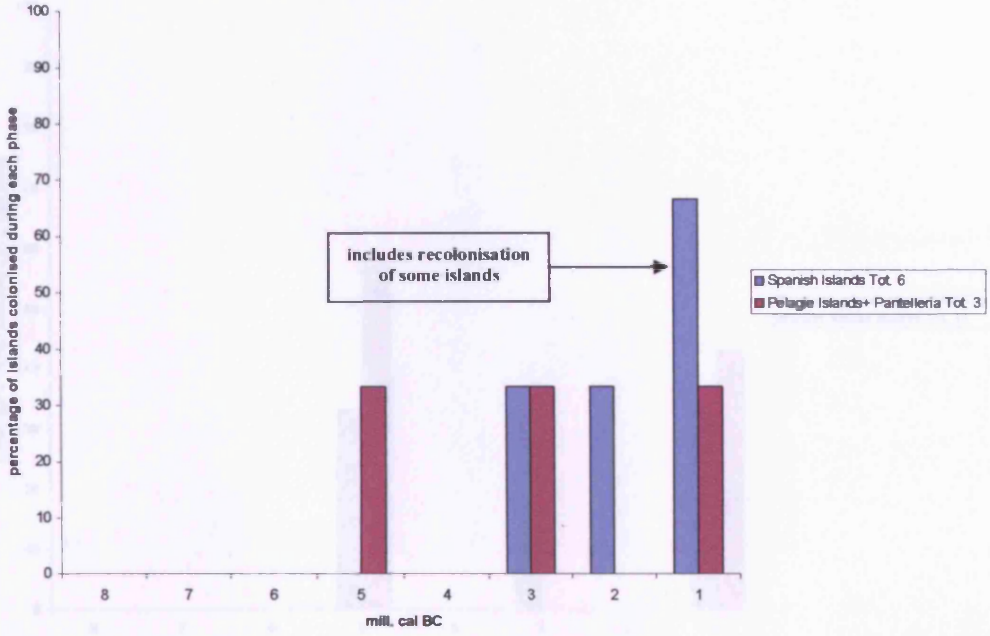


Fig. 5.58. Spanish Islands and Pelagie+Pantelleria. Non-cumulative plot.

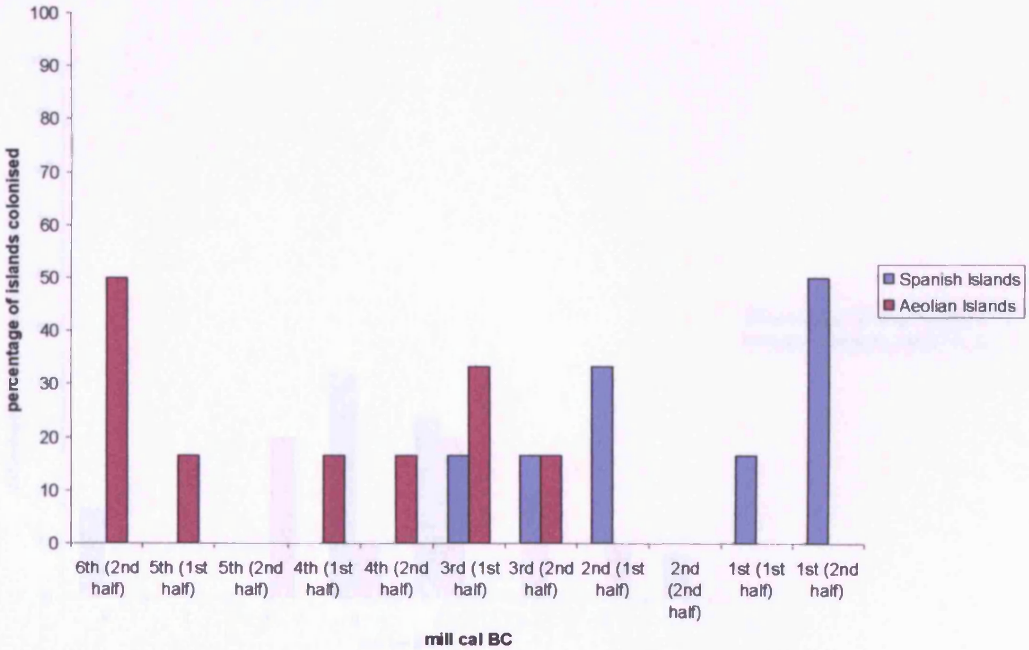


Fig. 5.59. Spanish and Aeolian Islands. Non-cumulative Plot (includes recolonisation).

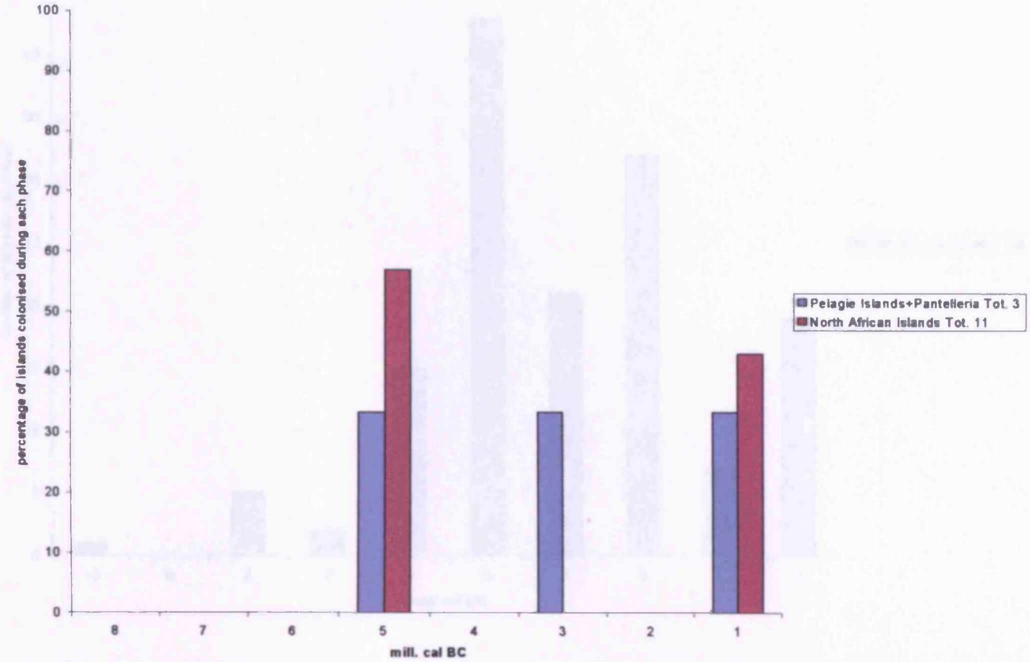


Fig. 5.60. North African islands and Pelagie+Pantelleria. Non-cumulative plot.

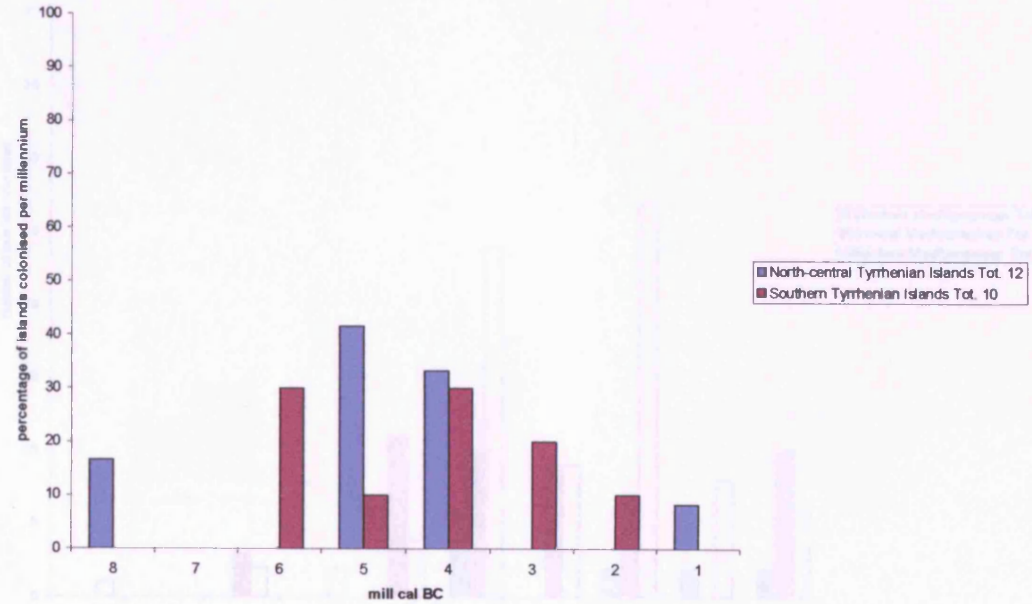


Fig. 5.61. North-central and Southern Tyrrhenian Islands. Non-cumulative plot.

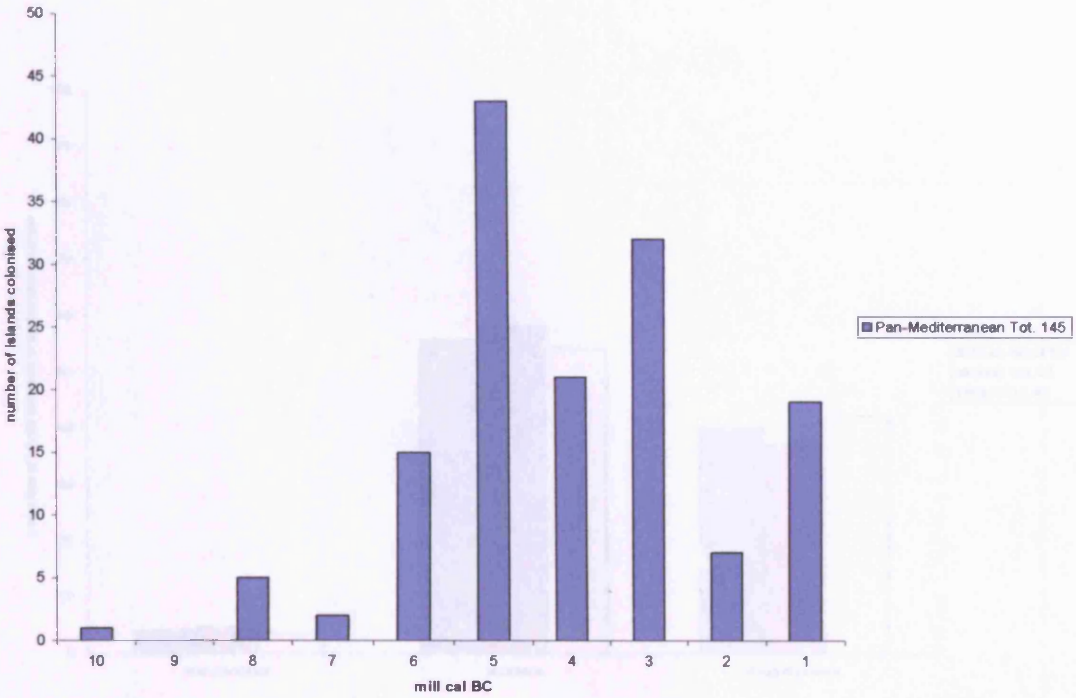


Fig. 5.62. Pan-Mediterranean non-cumulative colonisation plot

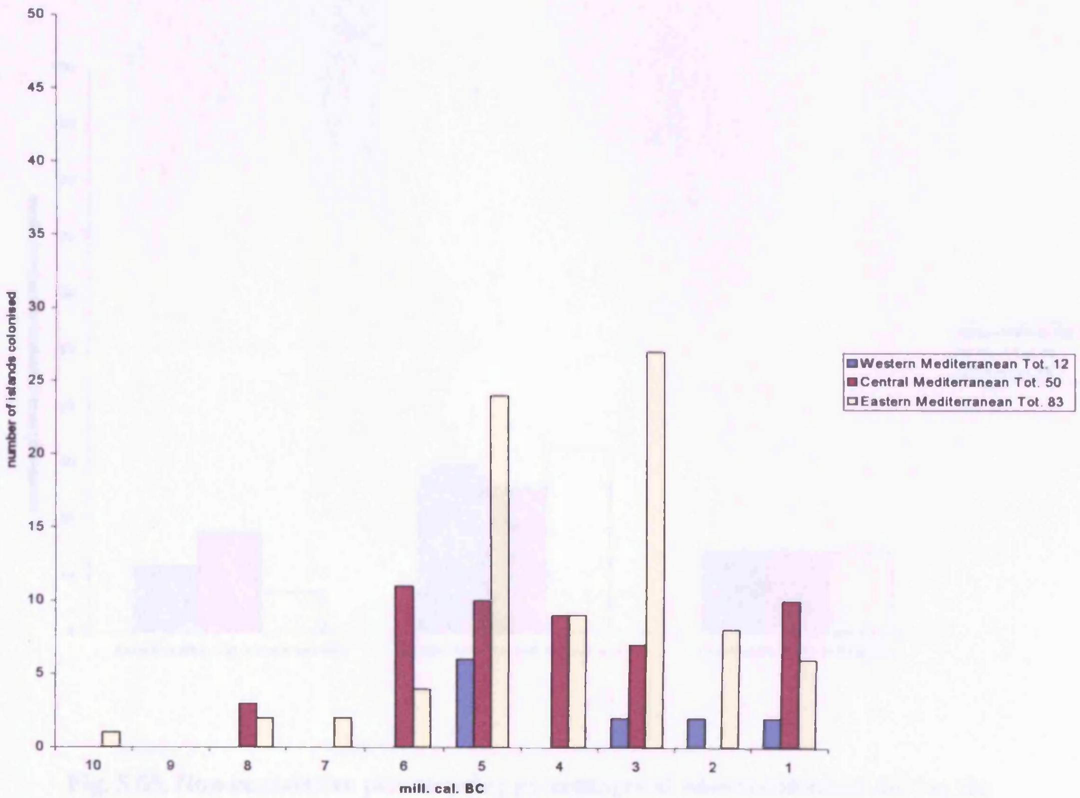


Fig. 5.63. Non-cumulative colonisation plot by zone

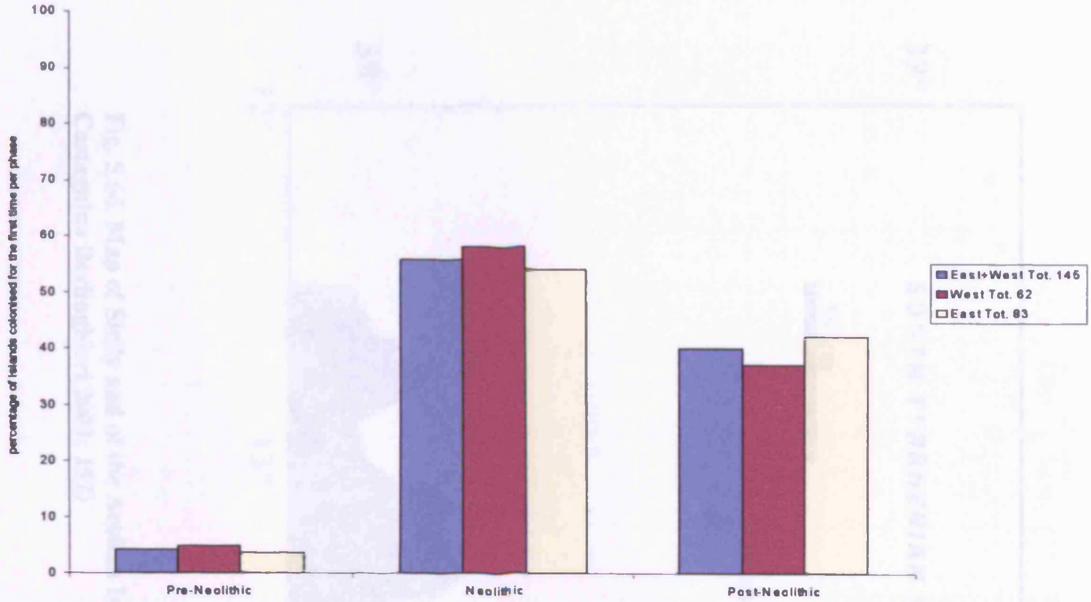


Fig. 5.64. Non-cumulative plot showing percentages of islands colonised before, during, and after the Neolithic

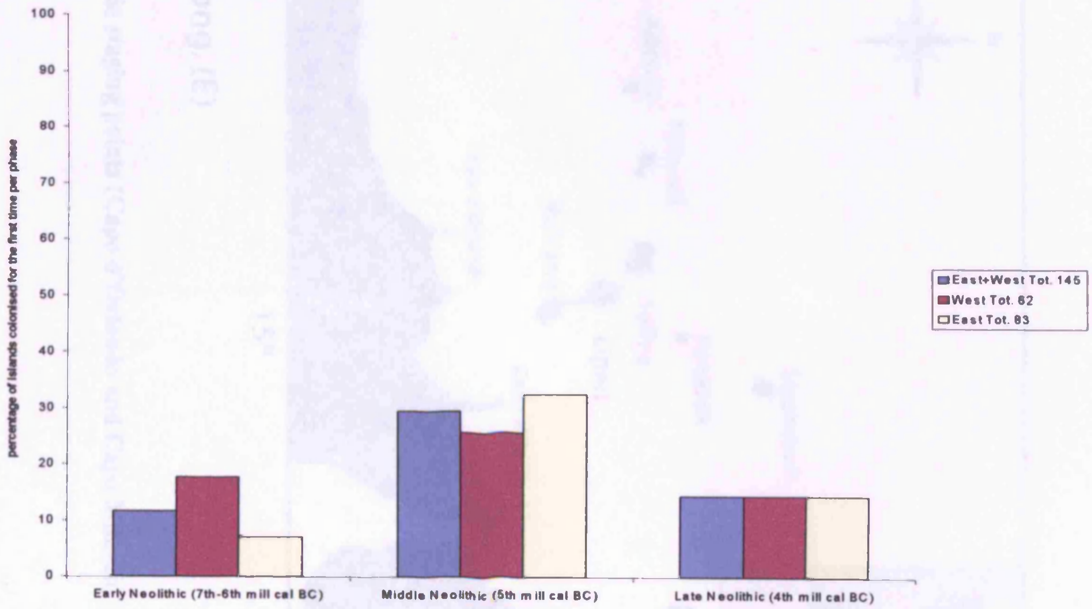


Fig. 5.65. Non-cumulative plot showing percentages of islands colonised during the Neolithic

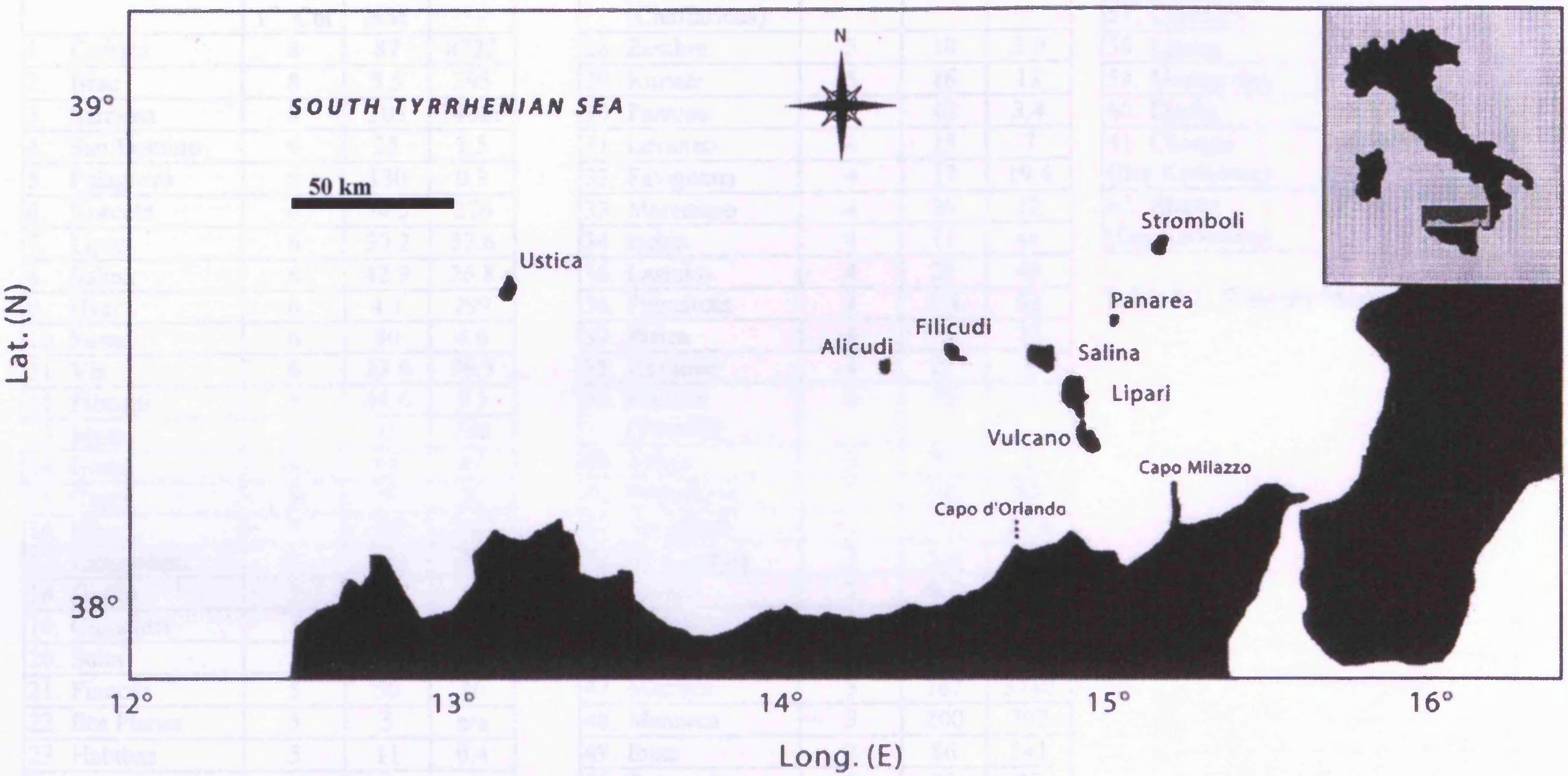


Fig. 5.66. Map of Sicily and of the Aeolian Islands with two possible staging points (Capo d'Orlando and Capo Milazzo) (adapted from Castagnino Berlinghieri 2003: 152)

Name	Mill. 1st Col	Dist. NM	Size
1. Corsica	8	87	8722
2. Brac	8	5.5	395
3. Sardinia	8	205	24089
4. San Domino	6	25	1.5
5. Palagruza	6	130	0.3
6. Korcula	6	34.5	276
7. Lipari	6	30.2	37.6
8. Salina	6	42.9	26.8
9. Hvar	6	4.1	299
10. Susac	6	80	4.6
11. Vis	6	23.6	90.3
12. Filicudi	6	46.6	9.5
13. Malta	6	80	246
14. Gozo	6	65	67
15. Capri	5	5	10
16. Elba	5	10	220
17. Lampedusa	5	210	20.2
18. Giglio	5	22	15
19. Giannutri	5	14	3
20. Solta	5	7.7	588
21. Pianosa	5	50	10
22. Iles Planes	5	5	n/a
23. Habibas	5	11	0.4
24. Rachgoun	5	2	n/a
25. Ile du Roi (Chaffarinas)	5	11	n/a
26. Ile d'Isabelle (Chaffarinas)	5	11	n/a
27. Ile du Congres (Chaffarinas)	5	11	n/a
28. Zembra	5	10	3.9
29. Kuriate	5	16	12
30. Panarea	5	42	3.4
31. Levanzo	4	15	7
32. Favignana	4	17	19.4
33. Marettimo	4	30	12
34. Ischia	4	11	46
35. Lastovo	4	25	49
36. Palmarola	4	1.4	32
37. Ponza	4	33	12
38. Zannone	4	27	4
39. Pianosa (Tremiti)	4	35	0.11
40. Ustica	3	53	8
41. Pantelleria	3	102	83
42. Stromboli	3	56.2	12.6
43. Sv Klement	3	5.6	3
44. Scedro	3	6.7	7.5
45. Svetac	3	47.6	4.3
46. Alicudi	3	87.5	5.2
47. Majorca	3	167	3740
48. Menorca	3	200	702
49. Ibiza	2	86	541
50. Formentera	2	95	82
51. San Nicola	1	25	0.5
52. Kopiste	1	87	1
53. Mjlet	1	18	98.6
54. Comino	1	70	2.6
55. Bisevo	1	27.8	5.8
56. Cabrera	1	175	13
57. Conejera	1	178	18
58. Linosa	1	19	5.4
59. Montecristo	1	10	63
60. Djerba	1	2.5	568
61. Chergui (Iles Kerkenna)	1	25	69
62. Rharbi (Iles Kerkenna)	1	25	n/a

Table 5.1. Western Mediterranean.

Name	Mill 1st Col	Dist. NM	Size
1. Cyprus	10	60	9251
2. Gioura	8	70	20
3. Kythnos	8	39	100
4. Crete	7	102	8259
5. Alonissos	6	43	65
6. Kyra Panagia	6	59	25
7. Skyros	6	33	210
8. Thasos	6	7	380
9. Lefkas	6	0.5	303
10. Corfu	5	5	593
11. Amorgos	5	105	124
12. Andros	5	55	380
13. Astypalaia	5	79	97
14. Chios	5	11	842
15. Giali	5	18	9
16. Kalymnos	5	18	93
17. Karpathos	5	93	301
18. Kasos	5	140	69
19. Kos	5	5	290
20. Kythera	5	15	280
21. Leros	5	32	53
22. Lesbos	5	12	1633
23. Mykonos	5	112	86
24. Naxos	5	132	430
25. Paros/Antiparos	5	115	196
26. Psara	5	67	40
27. Rhodes	5	19	1400
28. Salamis	5	0.5	96
29. Samos	5	5	477
30. Saria	5	85	21
31. Symi	5	8	38
32. Thera	5	180	76
33. Tilos	5	20	63
48. Ithaca	5	30	96
49. Kephalonia	5	38	781
50. Despotiko	5	112	8
34. Aegina	4	21	83
35. Alimnia	4	40	7
36. Chalki	4	47	28
37. Gavdos	4	192	30
38. Kea	4	22	131
39. Lemnos	4	62	478
40. Melos	4	105	151
41. Samothraki	4	37	178
42. Meganisi	4	9	20
51. Siphnos	4	85	74
52. Syros	4	75	85
53. Zakynthos	4	18	402
43. Delos	3	112	3
44. Dokos	3	2	20
45. Erymonisia	3	n/a	n/a
46. Idra	3	6	50
47. Imbros (Gokceada)	3	16	279
54. Ios	3	147	109
55. Keros	3	145	15
56. Kimolos	3	106	36
57. Kouphonisia	3	160	6
58. Makronisos	3	3	18
59. Pholegandros	3	131	32
60. Poros	3	0.5	23
61. Sikinos	3	140	35
62. Spetses	3	2	22
63. Tenedos (Bozcaada)	3	19	42
64. Donoussa	3	140	14
65. Heraklia	3	155	18
66. Schinoussa	3	157	9
67. Tinos	3	82	195
68. Nysiros	3	17	37
69. Reneia	3	105	14
70. Seriphos	3	62	75
71. Anafi	2	152	40
72. Lipsoi	2	37	17
73. Patmos	2	48	34
74. Skopelos	2	22	97
75. Therassia	2	178	9
76. Marsa Island	2	1	7
77. Antikythera	1	63	20
78. Arkos	1	10	5
79. Atokos	1	8	5
80. Castellorizo	1	5	10
81. Ikaria	1	47	256
82. Kalamos	1	2	25
83. Skiathos	1	4	50

Table 5.2. Eastern Mediterranean.

IONIAN	Size	dist NM
Corfu	593	5
Ithaca	96	30
Kalamos	25	2
Kephalonia	781	38
Lefkas	303	0.5
Meganisi	20	9
Zakynthos	402	18
Average	**317**	**15**

SW AEGEAN	Size	dist NM
Aegina	83	21
Poros	23	0.5
Salamis	96	0.5
Idra	50	6
Dokos	20	2
Spetses	22	2
Kythera	280	15
Antikythera	20	63
Atokos	5	8
Average	**66.5**	**13**

NORTHERN SPORADHES	Size	dist NM
Skiathos	50	4
Skopelos	97	22
Alonissos	65	43
Kyra Panagia	25	59
Gioura	20	70
Skyros	210	33
Average	**78**	**38.5**

CYCLADES	Size	dist NM
Andros	380	55
Tinos	195	82
Mykonos	86	112
Reneia	14	105
Schinoussa	9	157
Delos	3	112
Despotiko	8	112
Donoussa	14	140
Heraklia	18	155
Syros	85	75
Makronisos	18	3
Kea	131	22
Keros	15	145
Kimolos	36	106
Kouphonisia	6	160
Kythnos	100	39
Seriphos	75	62
Siphnos	74	85
Melos	151	105
Paros	196	115
Naxos	430	132
Amorgos	124	105
Ios	109	147
Sikinos	35	140
Pholegandros	32	131
Thera	76	180
Therassia	9	178
Anafi	40	152
Average	**85**	**107**

Table 5.3. Eastern Mediterranean Islands. Biogeographical Characteristics (continues on next page).

SE AEGEAN	Size	dist NM
Samos	477	5
Ikaria	256	47
Patmos	34	48
Arkos	5	10
Lipsoi	17	37
Leros	53	32
Kalymnos	93	18
Kos	290	5
Astypalaia	97	80
Castellorizo	10	5
Giali	9	18
Nysiros	37	17
Tilos	63	20
Symi	38	8
Rhodes	1400	19
Chalki	28	47
Alimnia	7	40
Saria	21	85
Karpathos	301	93
Kasos	69	140
Average	**165**	**39**

NE AEGEAN	Size	dist NM
Thasos	380	7
Samothraki	178	37
Imbros	279	16
Tenedos	42	19
Lemnos	478	62
Lesbos	1633	12
Psara	40	67
Chios	842	11
Average	**374**	**29**

ISLAND GROUP	AVERAGE SIZE (sq km)	AVERAGE DIST. NM*	BGR**
IONIAN	317	15	21.13
NE AEGEAN	374	29	12.89
SW AEGEAN	66.5	13	5.11
SE AEGEAN	165	39	4.23
N SPORADHES	78	38.5	2.02
CYCLADES	85	107	0.79

* Average distance to Nearest Mainland Km
** Overall BGR: Biogeographical ranking=average size/average distance (without stepping stone effect). Islands with higher BGR should be colonised earlier.

Table 5.3. Eastern Mediterranean Islands.Biogeographical Characteristics.

NORTH – CENTRAL TYRRHENIAN	Mill. 1st Col	Dist. NM	Size
Sardinia	8	205	24089
Corsica	8	87	8722
Elba	5	10	220
Giglio	5	22	15
Pianosa	5	50	10
Capri	5	5	10
Giannutri	5	14	3
Ischia	4	11	46
Palmarola	4	12	12
Ponza	4	33	12
Zannone	4	27	4
Montecristo	1	10	63
Average		**40.5**	**2767**

SOUTHERN TYRRHENIAN	Mill. 1st Col	Dist. NM	Size
Lipari	6	30.2	37.6
Salina	6	42.9	26.8
Filicudi	6	46.6	9.5
Panarea	5	42	3.4
Favignana	4	17	19.4
Marettimo	4	30	12
Levanzo	4	15	7
Stromboli	3	56.2	12.6
Ustica	3	53	8
Alicudi	3	87.5	5.2
Average		**42**	**14**

PELAGIE + MALTESE + NORTH AFRICAN	Mill. 1st Col	Dist. NM	Size
Malta	6	80	246
Gozo	6	65	67
Lampedusa	5	210	20.2
Kuriate	5	16	12
Zembra	5	10	3.9
Habibas	5	11	0.4
Iles Planes	5	5	n/a
Rachgoun	5	2	n/a
Ile du Roi (Chaffarinas)	5	11	n/a
Ile d'Isabelle (Chaffarinas)	5	11	n/a
Ile du Congres (Chaffarinas)	5	11	n/a
Pantelleria	3	102	83
Linosa	1	19	5.4
Comino	1	70	2.6
Average		**47**	**49**

ISLAND GROUP	AVERAGE SIZE (sq km)	AVERAGE DIST. NM*	BGR**
NORTH-CENTRAL TYRRHENIAN	2767	40.5	68.32
SOUTHERN TYRRHENIAN	14	42	0.3
PELAGIE + MALTESE+ NORTH-AFRICAN	49	13	3.76

* Average distance to Nearest Mainland (Km)
** Overall BGR: Biogeographical ranking= average size/average distance (without stepping stone effect). Islands with higher BGR should be colonised earlier.

Table 5.4. Western Mediterranean Islands. Biogeographical Characteristics

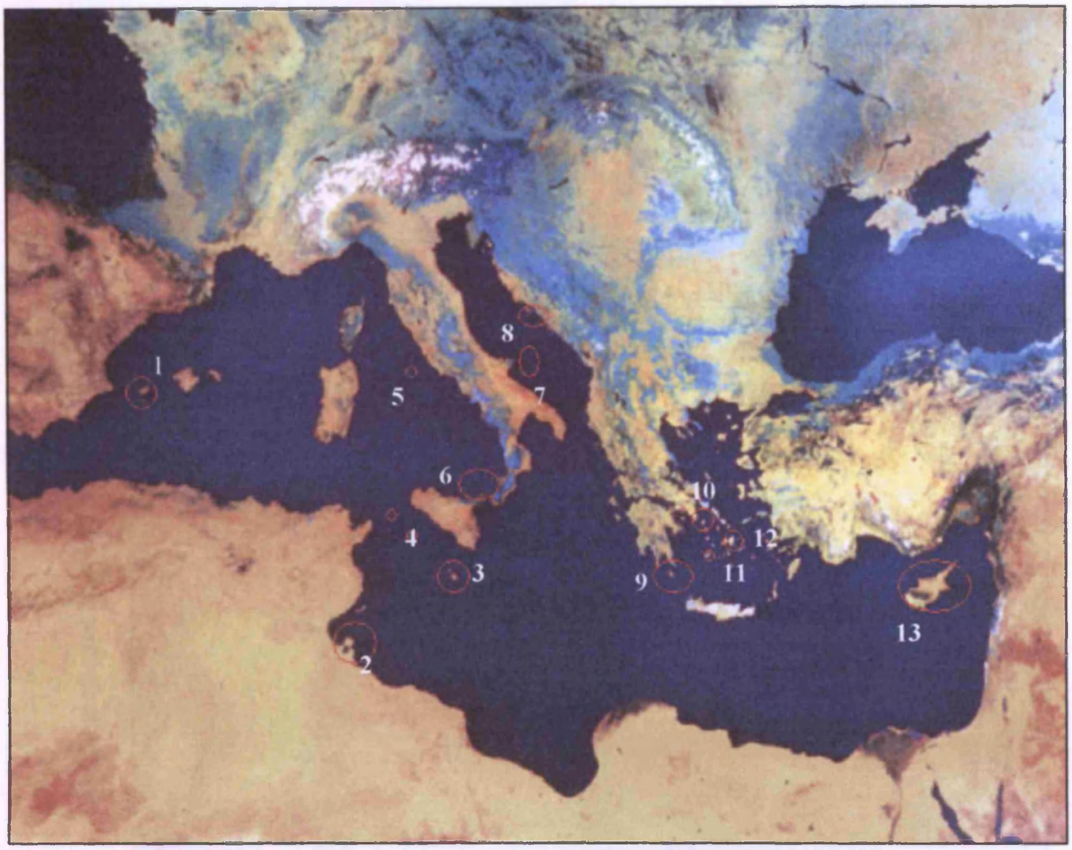


Fig. 7.1. Map with locations of case studies

1. Pitiussae Islands

2. Jerba

3. Malta

4. Pantelleria

5. Palmarola

6. Aeolian Islands

7. Tremiti - Palagruza

8. Hvar

9. Kythera

10. Kea

11. Melos

12. Naxos

13. Cyprus

Fig. 7.2. Map of Kythera (Archaeological Atlas of the Aegean)

Fig. 7.3. Map of Naxos (Archaeological Atlas of the Aegean)

Fig. 7.4. Map of Melos (Archaeological Atlas of the Aegean)

Fig. 7.5. Map of Kea (Archaeological Atlas of the Aegean)

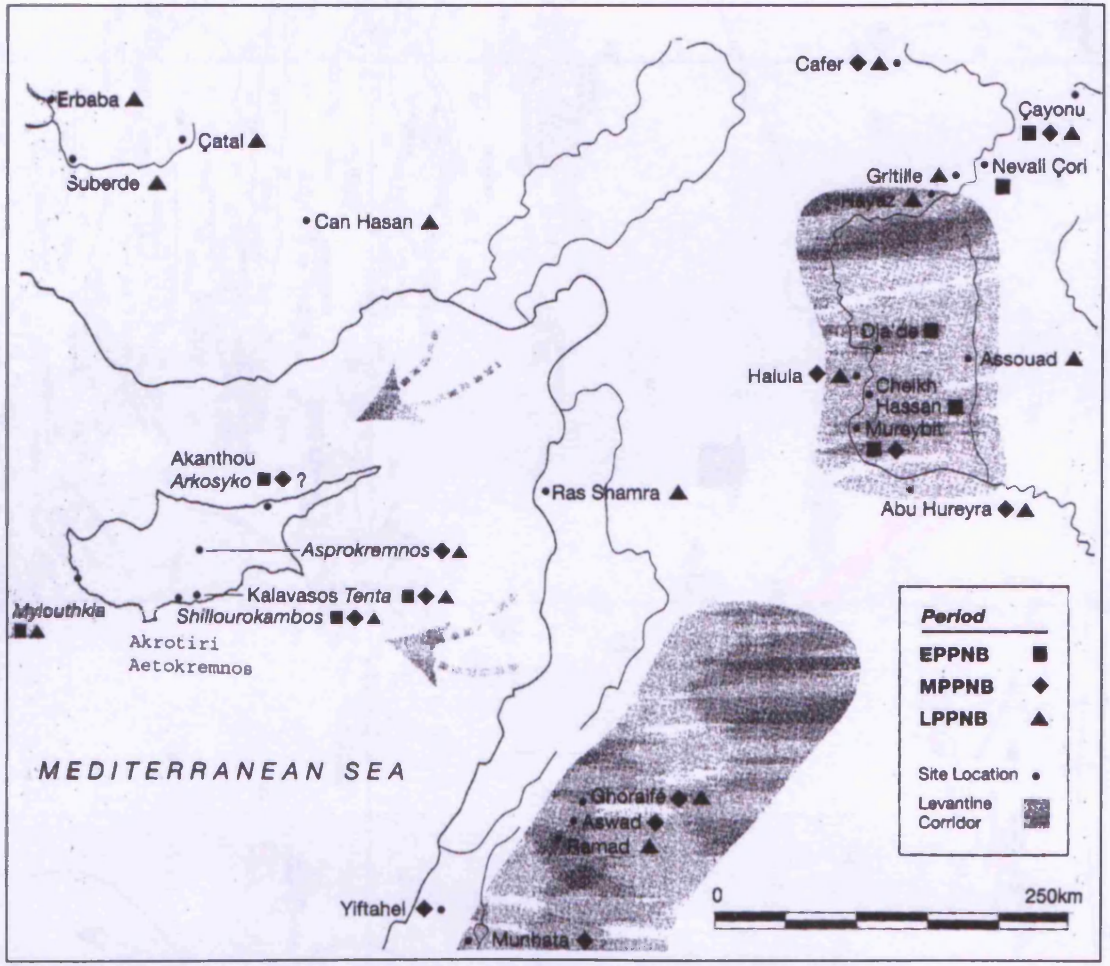


Fig. 7.6. Map of Cyprus and main archaeological sites (from Peltenburg *et al.* 2001: 36)

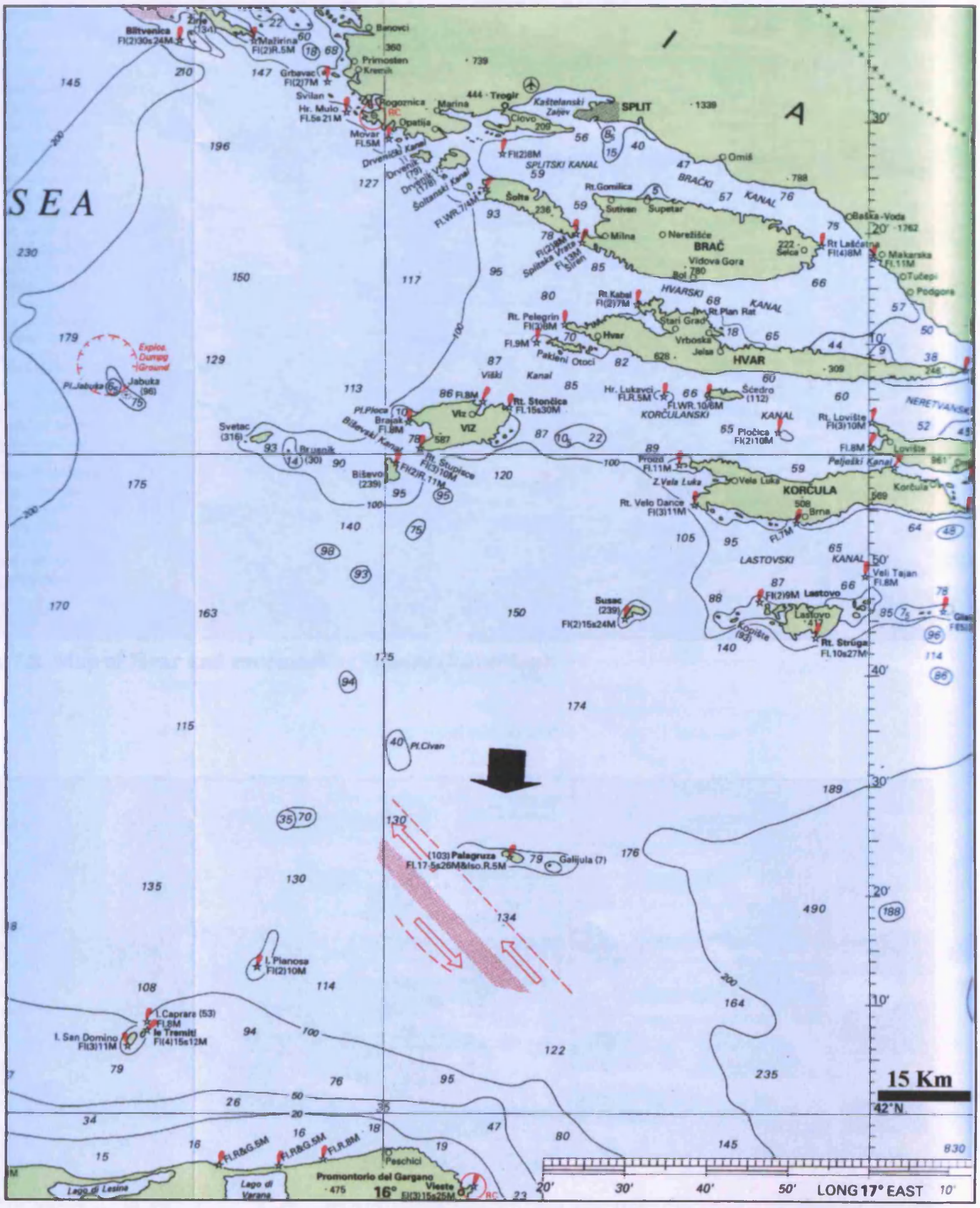


Fig. 7.7. Palagruza, Adriatic (Imray Nautical Chart)

Fig. 7.8. Map of Hvar and surrounding islands (EuroMap)

Fig. 7.9. Hvar Town, view of surrounding islets from fortified citadel

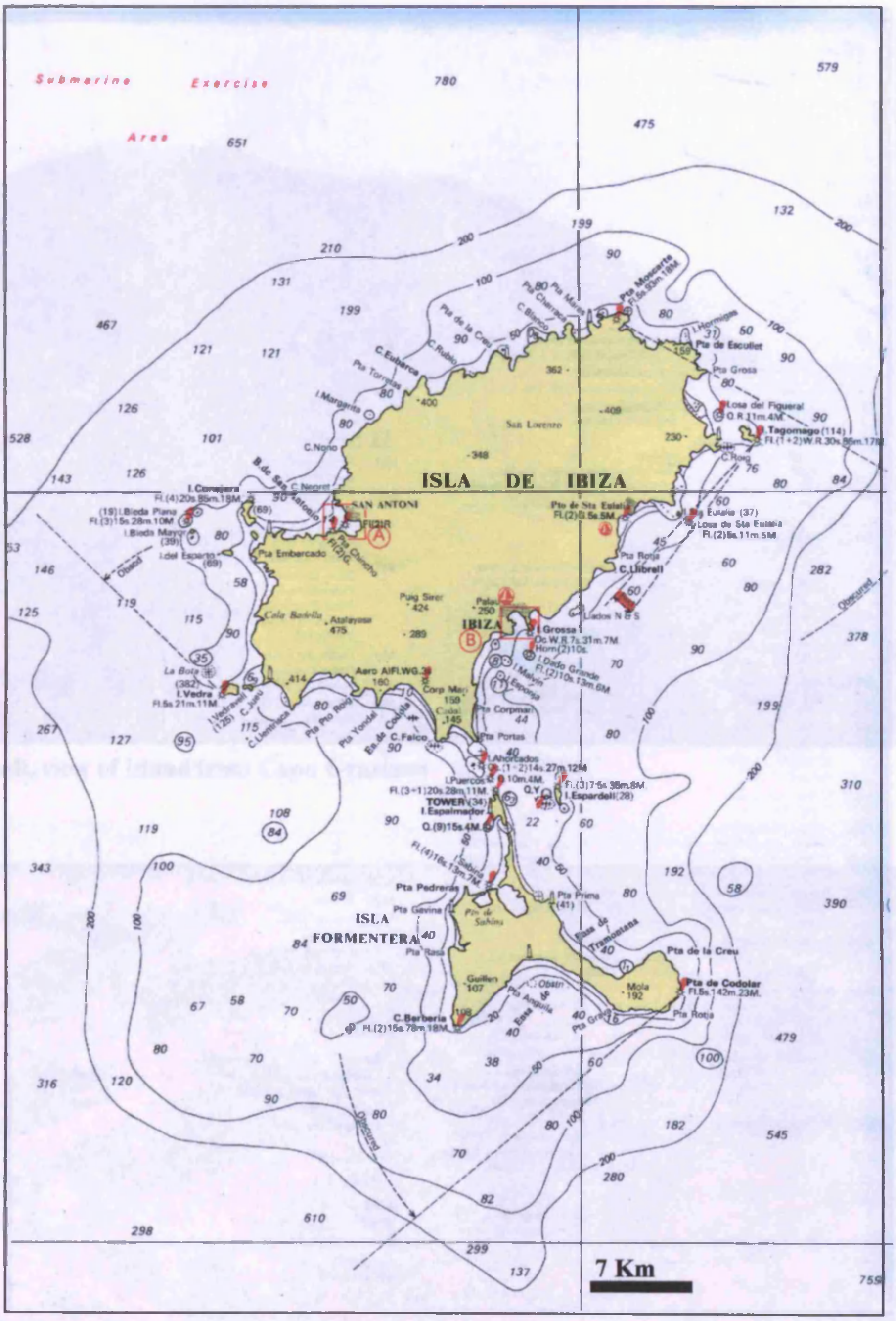


Fig. 7.10. Pitiussae Islands (Imray Nautical Chart)

Fig. 7.11. Filicudi, view of island from Capo Graziano

Fig. 7.12. Capo Graziano, Filicudi, hut.

Fig. 7.13. Punta Milazzese, Panarea

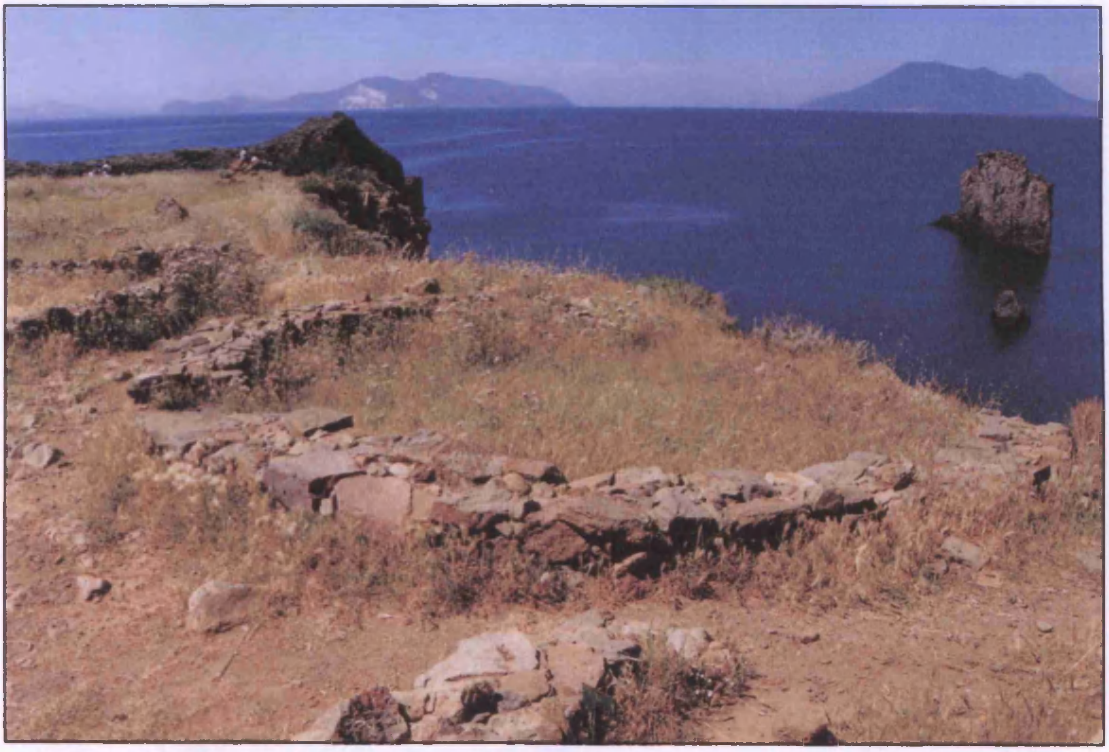


Fig. 7.14. Milazzese hut, Panarea

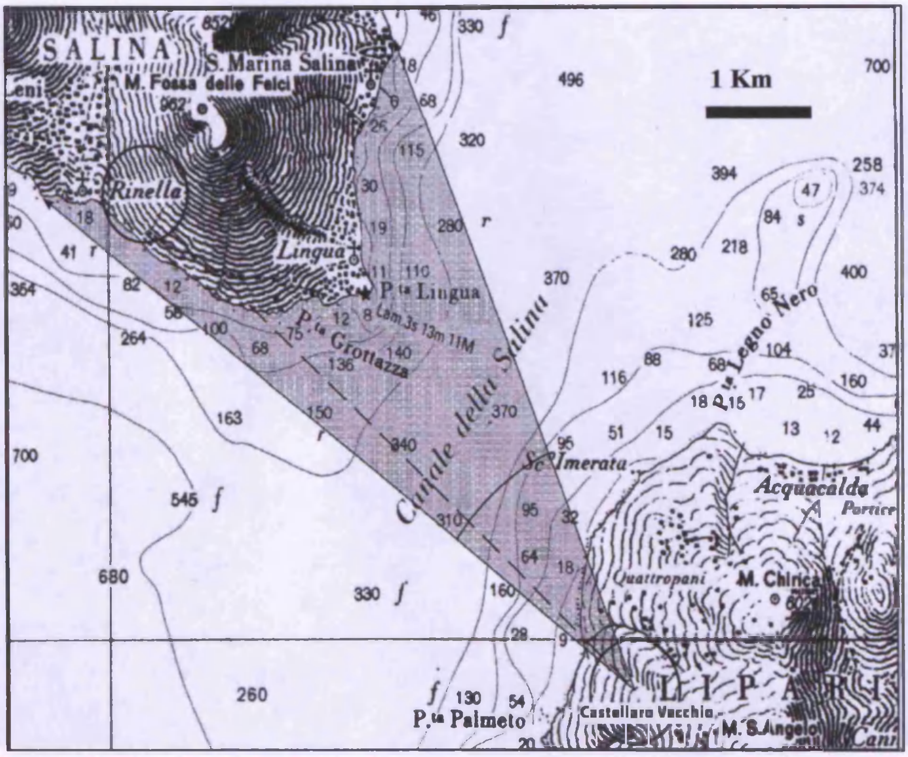


Fig. 7.15. View-range from Castellaro Vecchio (Lipari) towards Rinella (or Rinicedda) (Salina) (Castagnino Berlinghieri 2003: 181)

Fig. 7.16. Map showing location of Maltese Archipelago, Jerba, and Pantelleria (Times Atlas of the World)

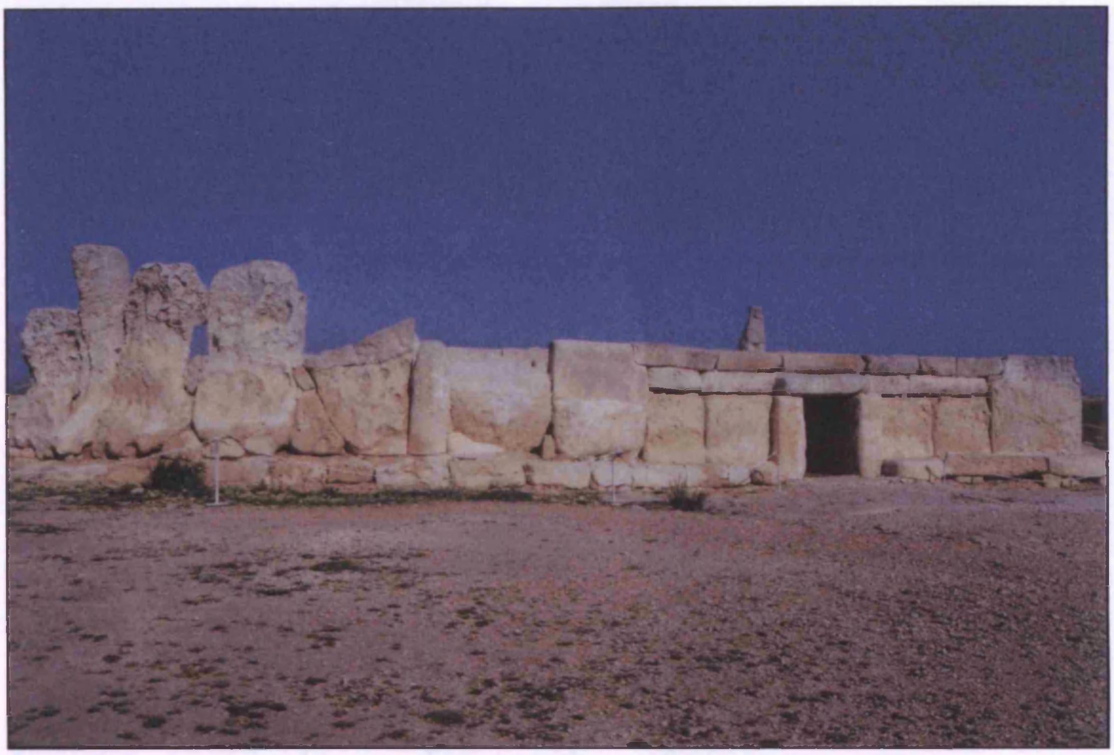


Fig. 7.17. Hagar Qim Temple , Malta.

Fig. 7.18. Dolmen, Malta

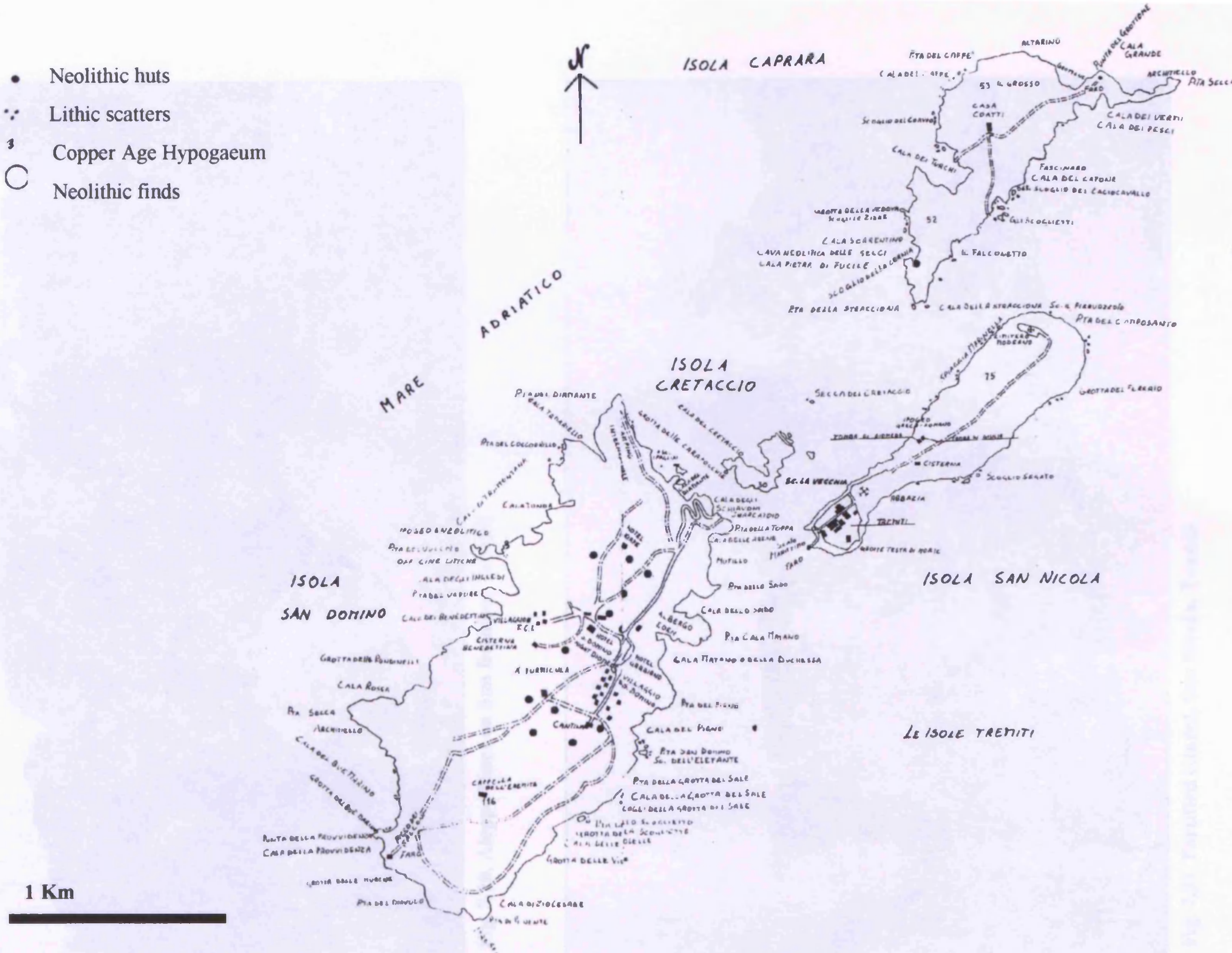


Fig. 7.19. Map of the Tremiti Islands (adapted from Fumo 1980)

Fig. 7.20. Aleppo Pines on San Domino, Tremiti

Fig. 7.21. Fortified citadel, San Nicola, Tremiti

NAME	SIZE sq Km	ALT. m a.s.l.	DIST. km	GROUND WATER	RAIN mm	Min. resources	pop 0.5	pop 1	pop 2	pop 3
Palagruza	0.3	90	130	no	n/a	yes	<1	<1	<1	1
San Nicola	0.4	75	20	no	500	no	<1	<1	<1	1.2
Palmarola	1.4	262	32	no	n/a	yes	<1	1.4	2.8	4.2
San Domino	2	116	20	no	500	no	1	2	4	6
Panarea	3.4	421	42	no	500	no	1.7	3.4	6.8	10.2
Alicudi	5.2	675	87	no	500	no	2.6	5.2	10.4	15.6
Filicudi	9.5	774	47	no	500	no	4.75	9.5	19	37.8
Stromboli	12.6	924	56	no	500	no	6.3	12.6	24.6	37.8
Vulcano	21	500	22	no	500	yes	10.5	21	42	63
Salina	26.8	962	43	no	500	no	13.4	26.8	53.6	80.4
Lipari	37.6	602	30	no	500	yes	18.8	37.6	75.2	112.8
Formentera	82	202	95	no	370	no	41	82	164	246
Pantelleria	83	836	102	no	350	yes	41.5	83	166	249
Kea	130.6	568	12	yes	490	no	51.8	103.6	207.2	391.8
Melos	150.6	751	105	no	435	yes	75.3	150.6	301.2	451.8
Malta	246	253	85	yes	500	no	123	246	492	738
Kythera	280	507	15	yes	660	no	140	280	560	840
Hvar	312	626	4	no	800	no	156	312	624	936
Naxos	428	1000	132	yes	384	yes	214	428	856	1284
Jerba	568	40	2	no	200	no	284	568	1136	1704
Ibiza	572	475	92	yes	400	no	286	572	1144	1716
Average	**155.3**	**520.9**	**59**		**480**		**82**	**164**	**327**	**442**
Cyprus	9251	1950	69	yes	500	yes	4626	9251	18502	27753

Table 7.1. Geographical characteristics and population estimates.
Alt: Highest point
Dist: Distance from nearest mainland.
Pop.: Population estimates at 0.5 people/sq km; 1p/sq km; 2 p/sq km; 3p/sq km.

DATE	PERIOD	STATUS
ca. 4500 - ca. 3300 BC	Neolithic	Exploitation, perhaps sporadically occupied
ca. 3300 - ca. 2300 BC	Grotta-Pelos and Keros-Syros cultures	Dispersed, probably autonomous homesteads. Local autonomy.
ca. 2300 - ca. 2000 BC	Phylakopi I	Trend towards nucleated settlements, some ranking, island autonomy
ca. 2000 – ca. 1600 BC	Phylakopi II	Nucleated settlement. Possible state formation, island autonomy
ca. 1600 – ca. 1400 BC	Phylakopi III	Possible Cretan assimilation
ca. 1400 – ca. 1100 BC	Phylakopi IV	Possibly independent Melian state
ca. 1100- ca. 700 BC	Iron Age	Initial fragmentation (or abandonment), perhaps homesteads, early settlement at Ancient Melos.
ca. 700 – 416/415 BC	Archaic and Classical	Independent state of Melos
416/415-405 BC	Late Classical	Athenian colony
405-338 BC	Late Classical	Spartan domination
338-c 150 BC	Hellenistic	Macedonian domination
ca. 150-ca. AD 300	Roman	Roman domination
ca. AD 300-ca. 650	Later Roman/Byzantine	Melos dominated by Nicomedia, then Costantinople. Ancient Melos abandoned in the 5th c. AD: settlement dispersal.
ca. AD 650-ca. 960	Byzantine	Arab-Byzantine conflict.
ca. AD 960-1207	Late Byzantine	Lack of effective control from Costantinople. Quasi-autonomy. Used as a pirate base.
AD. 1207- 1564	Frankish (Duchy of Naxos)	Venetian domination. Autonomy of the Duchy.
AD 1564-1820	Ottoman	Domination of Istanbul
AD 1821- present	Greek independence	Governed initially from Nauplia, then from Athens.

Table 7.2. Political status of Melos through time (adapted from Renfrew 1982b: 265).

PERIOD	SITES	POP. OF KEOS	EXT. CONTROL	COMMENT
Neolithic (Later 5th-4th mill. cal BC)	Few settlements; none dominant	Low; largest settlement prob. <100	None	Island colonised for first time
ECyc (late 4th-3rd mill. cal BC)	Single primate centre at Ayia Irini, almost total nucleation	Max. 780-1250 at Ayia Irini	None	Recolonisation after abandonment?
MCyc-LCycII 2nd- ca. 1450 cal BC	Same	Same	None?	Recolonisation after abandonment?
LCyc III ca. 1450-ca. 1100 cal BC	Same	Considerably reduced	None?	-
PG-G 1050-700 cal BC	Specialised religious facility at Ayia Irini, no evidence for central places.	Very low	None? Euboea?	Northern Keos largely abandoned?
A-Early HL 7th-4th c. BC	Primate centres at Koressos and Ioulis; considerable sett. in rural hinterland.	High; over 4,000 on the island, over 1,000 in Koressos.	Athenian Leagues; Ptolemaic Egypt.	No evidence that either centre formed through aggregation of smaller dispersed communities.
Late HL-ER 1st c. BC-AD 3rd c.	Primate centre at Ioulis; almost total nucleation	?	Athens; Rome	Polis of Koressos has collapsed and centre is deserted.
LR 4th-7th c. AD	Primate centre at Ioulis; some rural sett.	?	Athens? Rome	-
EByz mid 8th-10th c. AD	Primate centre at Ioulis, total nucleation?	?	Byzantine Empire	Ioulis now becomes Chora – only settlement on island?
MByz 10th-early 13th c. AD	?	?	Byzantine Empire	Same
LByz-Venetian mid 13th-mid 16th c. AD	Primate centre at Ioulis; little or no rural sett.	Low? CA. 1,500?	Byzantine Empire, Venice and dependencies	Same
Turkish mid 16th c. - 1833 AD	Same	ca. 4,000-5,000 in later 17th to early 19th c.	Turkish Empire	Same
Modern	Considerable rural settlement, primate function of Ioulis eroding, establishment of weak settlement hierarchy.	ca. 3,200 in 1828; peaks at ca. 4,900 in 1896; falls to less than 1,700 at present	Modern Greek State	Several permanent settlements other than Ioulis

Table 7.3. Kea chronology (adapted from Cherry *et al.* 1991).

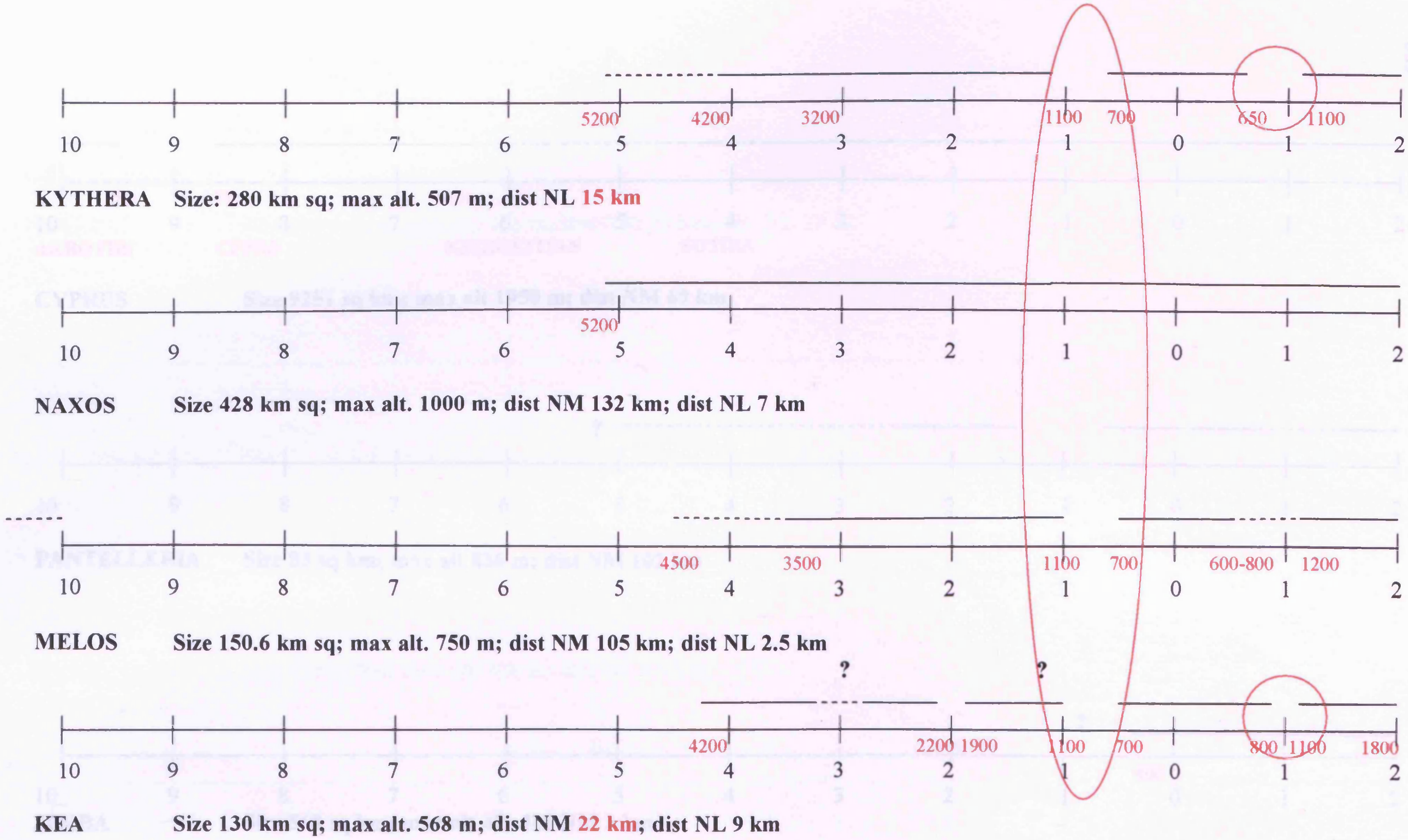

5200 4200 3200 1100 700 650 1100
10 9 8 7 6 5 4 3 2 1 0 1 2
KYTHERA Size: 280 km sq; max alt. 507 m; dist NL 15 km
5200
10 9 8 7 6 5 4 3 2 1 0 1 2
NAXOS Size 428 km sq; max alt. 1000 m; dist NM 132 km; dist NL 7 km
4500 3500 1100 700 600-800 1200
10 9 8 7 6 5 4 3 2 1 0 1 2
MELOS Size 150.6 km sq; max alt. 750 m; dist NM 105 km; dist NL 2.5 km
? ?
4200 2200 1900 1100 700 800 1100 1800
10 9 8 7 6 5 4 3 2 1 0 1 2
KEA Size 130 km sq; max alt. 568 m; dist NM 22 km; dist NL 9 km

Fig. 7.22

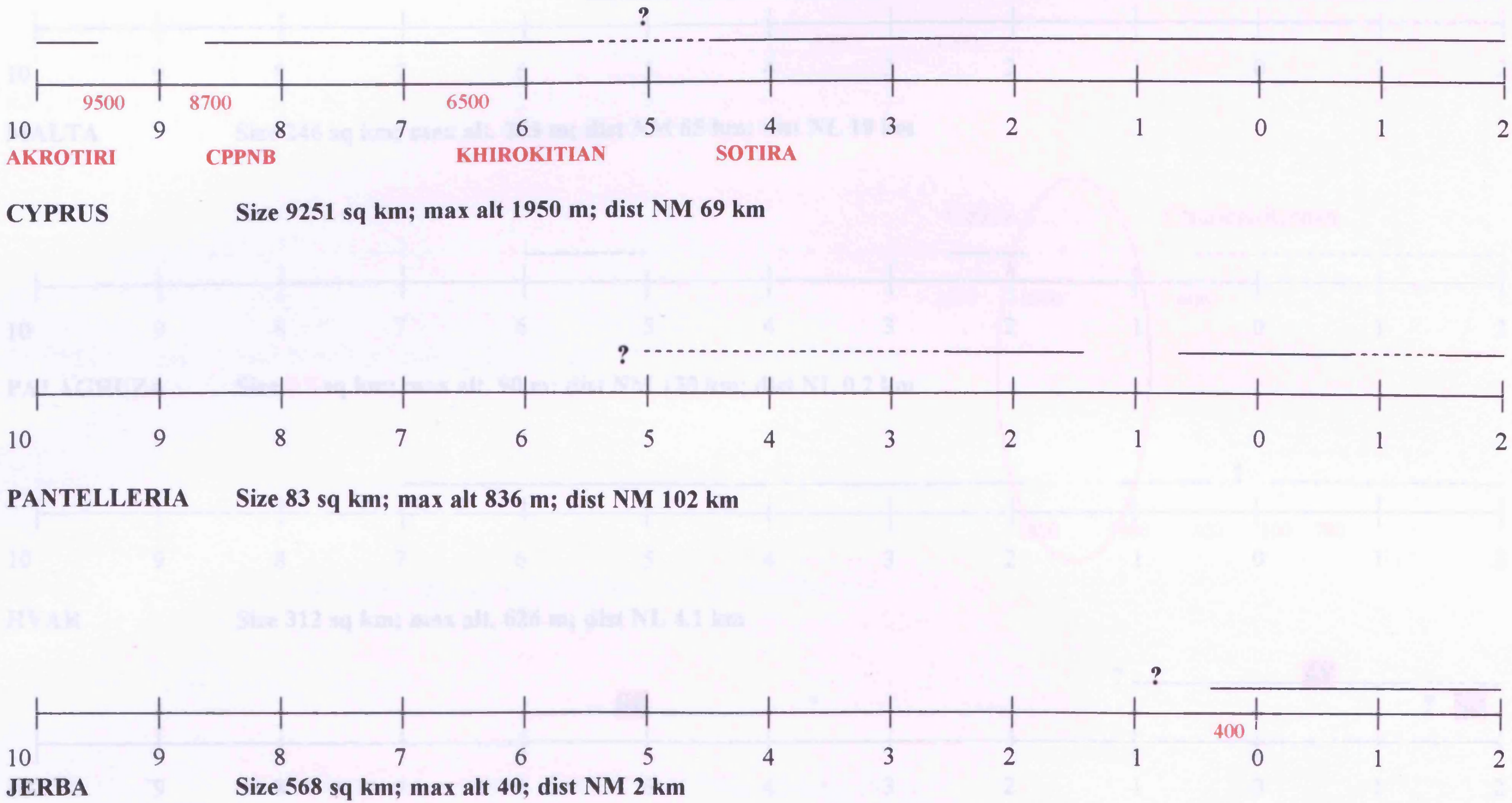

?
9500
8700
6500
10 9 8 7 6 5 4 3 2 1 0 1 2
AKROTIRI
CPPNB
KHIROKITIAN
SOTIRA
CYPRUS
Size 9251 sq km; max alt 1950 m; dist NM 69 km
?
10 9 8 7 6 5 4 3 2 1 0 1 2
PANTELLERIA
Size 83 sq km; max alt 836 m; dist NM 102 km
?
400
10 9 8 7 6 5 4 3 2 1 0 1 2
JERBA
Size 568 sq km; max alt 40; dist NM 2 km

Fig. 7.23

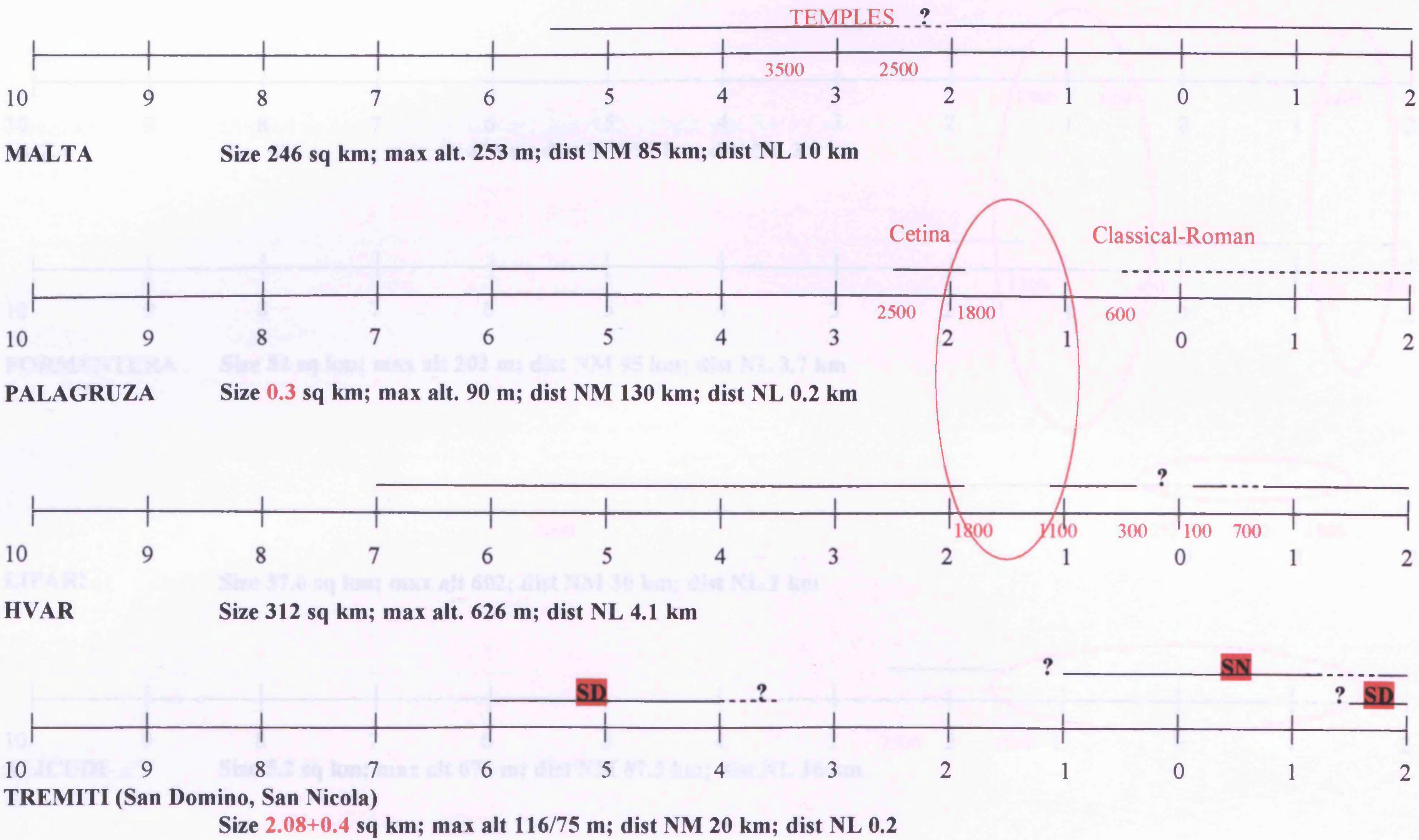

TEMPLES ?
3500
2500
10 9 8 7 6 5 4 3 2 1 0 1 2
MALTA
Size 246 sq km; max alt. 253 m; dist NM 85 km; dist NL 10 km
Cetina
Classical-Roman
2500
1800
600
10 9 8 7 6 5 4 3 2 1 0 1 2
PALAGRUZA
Size 0.3 sq km; max alt. 90 m; dist NM 130 km; dist NL 0.2 km
?
1800
1100
300
100
700
10 9 8 7 6 5 4 3 2 1 0 1 2
HVAR
Size 312 sq km; max alt. 626 m; dist NL 4.1 km
SD
?
?
SN
?
SD
10 9 8 7 6 5 4 3 2 1 0 1 2
TREMITI (San Domino, San Nicola)
Size 2.08+0.4 sq km; max alt 116/75 m; dist NM 20 km; dist NL 0.2

Fig. 7.24

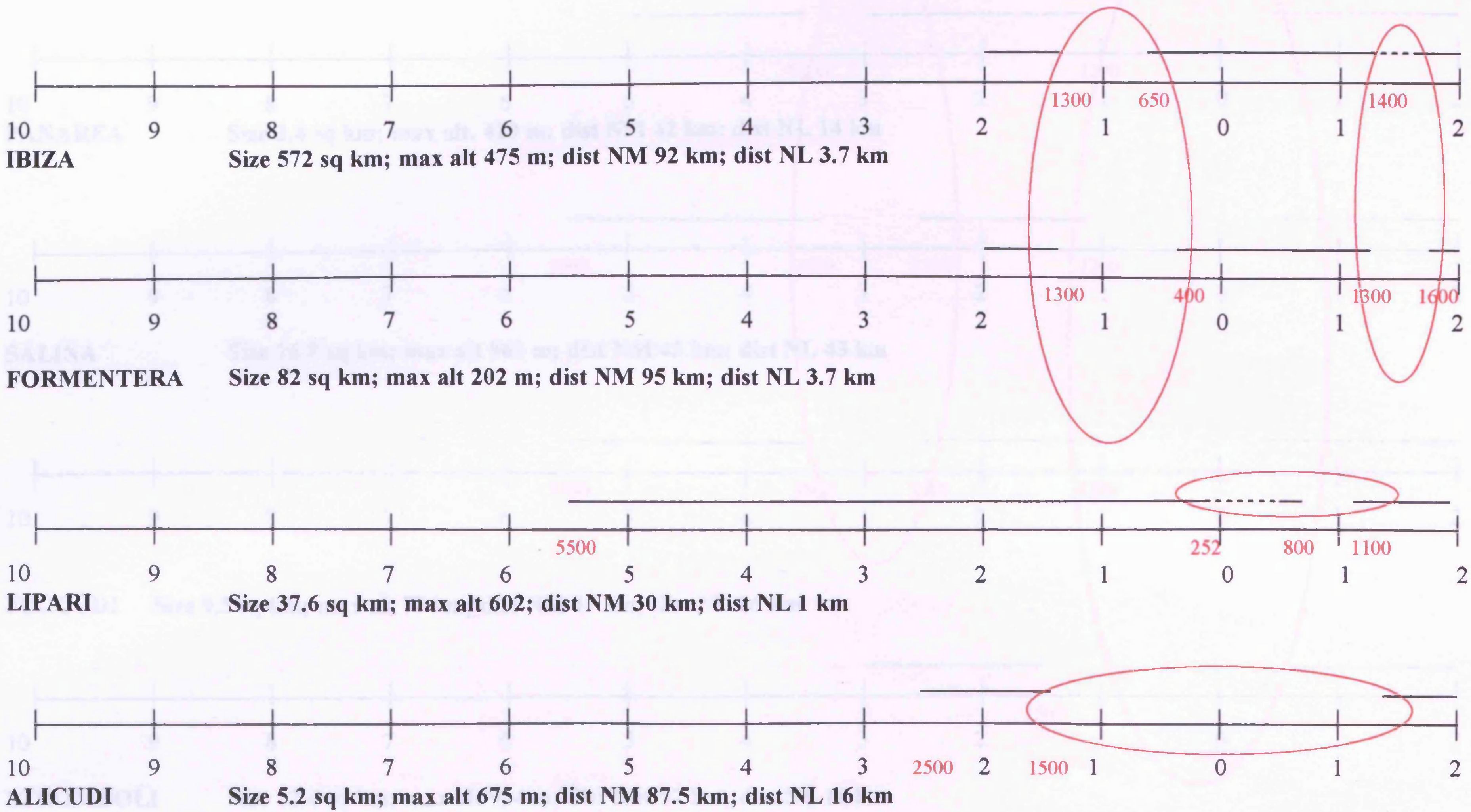
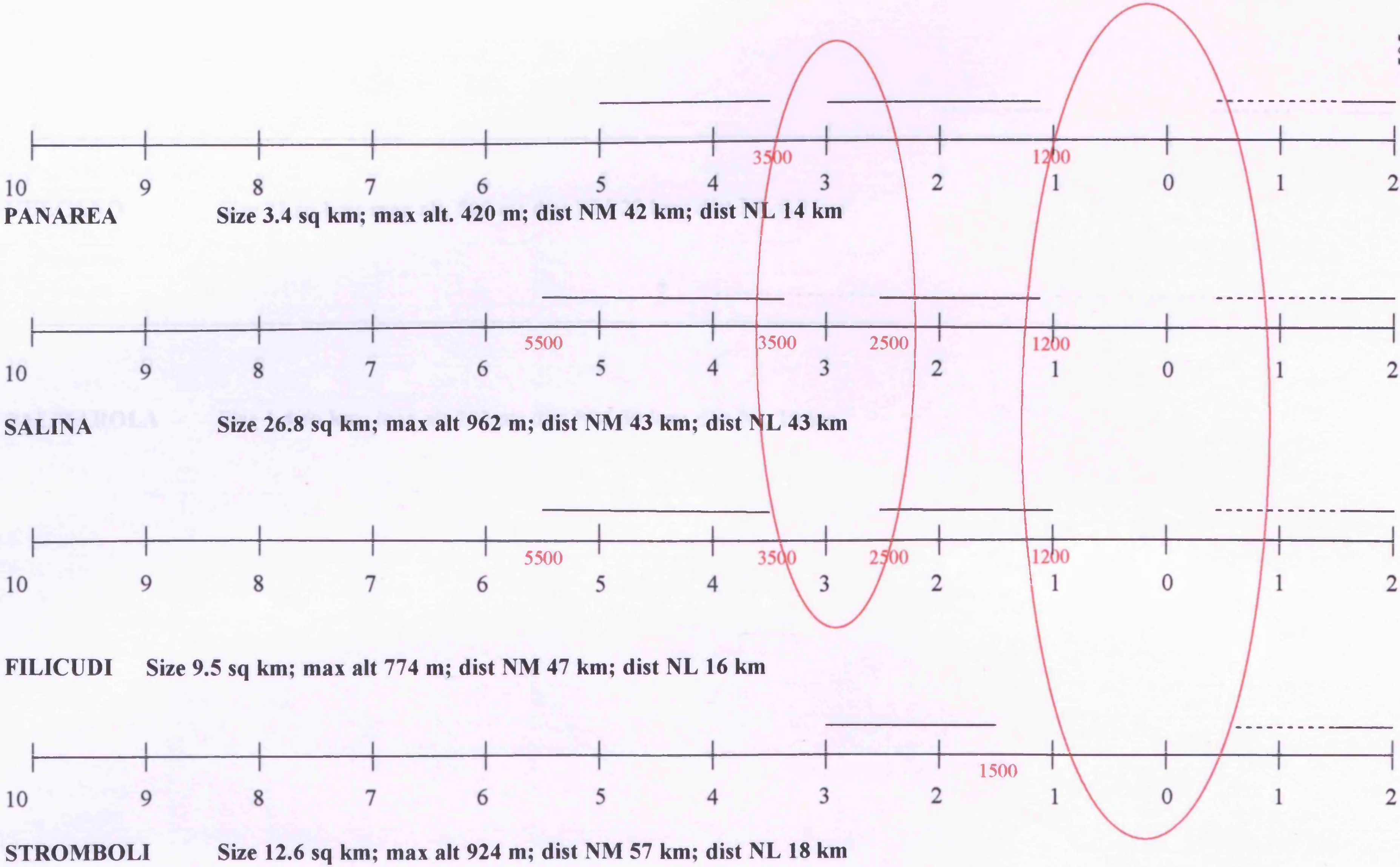
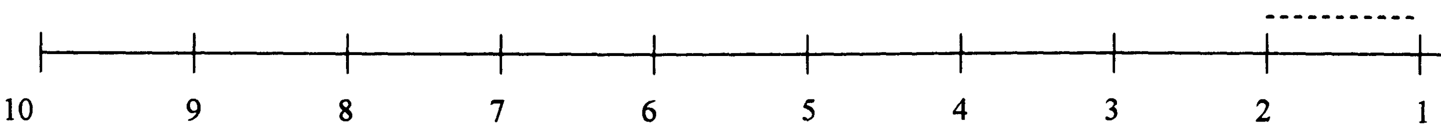

1300
650
1400
10 9 8 7 6 5 4 3 2 1 0 1 2
IBIZA
Size 572 sq km; max alt 475 m; dist NM 92 km; dist NL 3.7 km
1300
400
1300
1600
10 9 8 7 6 5 4 3 2 1 0 1 2
FORMENTERA
Size 82 sq km; max alt 202 m; dist NM 95 km; dist NL 3.7 km
5500
252
800
1100
10 9 8 7 6 5 4 3 2 1 0 1 2
LIPARI
Size 37.6 sq km; max alt 602; dist NM 30 km; dist NL 1 km
2500
1500
10 9 8 7 6 5 4 3 2 1 0 1 2
ALICUDI
Size 5.2 sq km; max alt 675 m; dist NM 87.5 km; dist NL 16 km

Fig. 7.25

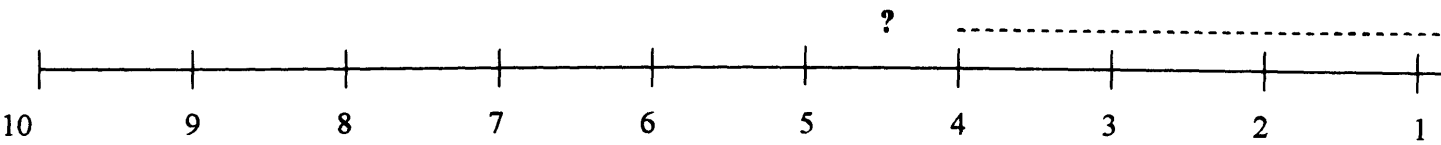


3500
1200
10 9 8 7 6 5 4 3 2 1 0 1 2
PANAREA Size 3.4 sq km; max alt. 420 m; dist NM 42 km; dist NL 14 km
5500
3500
2500
1200
10 9 8 7 6 5 4 3 2 1 0 1 2
SALINA Size 26.8 sq km; max alt 962 m; dist NM 43 km; dist NL 43 km
5500
3500
2500
1200
10 9 8 7 6 5 4 3 2 1 0 1 2
FILICUDI Size 9.5 sq km; max alt 774 m; dist NM 47 km; dist NL 16 km
1500
10 9 8 7 6 5 4 3 2 1 0 1 2
STROMBOLI Size 12.6 sq km; max alt 924 m; dist NM 57 km; dist NL 18 km

Fig. 7.26



VULCANO **Size 21 sq km; max alt. 500 m; dist NM 22 km; dist NL 0.8 km**



PALMAROLA **Size 1.4 sq km; max alt 262 m; dist NM 30 km; dist NL 10 km**

Fig. 7.27

	Island	Size sq km	Max Alt m	Dist NM km	Dist NL km	Ground water	Rain mm/yr	Min. res.	1st col. Mill.	1st aband. Mill.	Tot occupation years	Tot aband. years
1	**Palagruza**	0.3	90	130	0.2	No	n/a	Y	6 BC	5 BC	1000+700+2600	2500+1200
2	**San Nicola**	0.4	75	20	0.2	No	500	N	1 BC	1 AD	3000	200
3	**San Domino**	2	116	20	0.2	No	500	N	6 BC	4 BC	2000+500	5000
4	**Panarea**	3.4	421	42	14	No	500	N	5 BC	4 BC	1500+1800+1500	500+1700
5	**Alicudi**	5.2	675	87	15.5	No	500	N	3 BC	2 BC	1000+500	3000
6	**Filicudi**	9.5	774	47	15.5	No	500	N	6 BC	4 BC	2000+1300+1500	1000+1700
7	**Stromboli**	12.6	924	56	18.25	No	500	N	3 BC	2 BC	1500+1500	2000
8	**Salina**	26.8	962	43	4.25	No	500	N	6 BC	4 BC	2000+1300+1500	1000+1700
9	**Lipari**	37.6	602	30	0.875	No	500	Y	6 BC	1 BC	5250+200+900	350+300
10	**Formentera**	82	202	95	3.7	No	370	N	2 BC	2 BC	700+1700+400	900+300
11	**Pantelleria**	83	836	102	70	No	350	Y	3 BC	2 BC	1000+2500	1000
12	**Kea**	130.6	568	12	9	Yes	492	N	4 BC	3 BC	1800+800+1500+700	300+400+300
13	**Melos**	150.6	751	105	2.5	No	435	Y	4 BC	2 BC	2900+1200+1300	400+200
14	**Malta**	246	253	85	10	Yes	500	N	6 BC	-	7500	-
15	**Kythera**	280	507	15	15	Yes	662	N	5 BC	2 BC	3900+1350+900	400+450
16	**Hvar**	312	626	4	2	No	800	N	6 BC	2 BC	4200+800+1900	700+400
17	**Naxos**	428	1000	132	7	Yes	384	Y	5 BC	-	7200	-
18	**Jerba**	568	40	2	2	No	200	N	1 BC	-	2400	-
19	**Ibiza**	572	475	92	3.7	Yes	400	N	2 BC	2 BC	700+2650	650
	Average (without Cyprus)	**155**	**521**	**59**	**10**		**477**				**4476 (ca. 1890 yrs/period)**	**1503 (ca. 1057 yrs/period)**
20	**Cyprus**	9251	1950	69	69	Yes	500	Y	10 BC	10 BC	500+3000+6700	800+1000

Table 7.4. Study 1. Assessing overall patterns **(continues on next page)**

	Average (with Cyprus)	610	592	59	13		479				4763 (ca. 19

Table 7.4. Study 1. Assessing overall patterns.

Total occupation*: 95250 years (85050 without Cyprus)
Average overall occupation*: Total/ n islands=95250 /20=4763 years (4476 without Cyprus)
Average occupation period*: Total/n periods=95250 /48=1984 years (1890 without Cyprus)
(n periods= 48; 45 without Cyprus)

Total abandonment*: 30350 years (28550 without Cyprus)
Average overall abandonment*: Total years/n islands=30350 /20=1518 years (1503 without Cyprus)
Average abandonment period*: Total years/n periods=30350 /29=1047 years (1057 without Cyprus)
(n periods= 29; 27 without Cyprus)

*** Vulcano and Palmarola not included**

Island	1st col. Mill.	1st aband. Mill.	Tot prehistoric occupation years	Occupation bridging P and H	Tot historic occupation	Tot prehistoric aband. years	Abandonment bridging P and H	Tot historic aband. years
Palagruza	6 BC	5 BC	1000+700	2600		2500+1200		
San Nicola	1 BC	1 AD		3000		-		200
San Domino	6 BC	4 BC	2000		500		5000	
Panarea	5 BC	4 BC	1500+1800		1500	500	1700	
Alicudi	3 BC	2 BC	1000		500		3000	
Filicudi	6 BC	4 BC	2000+1300		1500	1000	1700	
Stromboli	3 BC	2 BC	1500		1500		2000	
Salina	6 BC	4 BC	2000+1300		1500	1000	1700	
Lipari	6 BC	1 BC	5250		200+900			350+300
Formentera	2 BC	2 BC	700	1700	400	900		300
Pantelleria	3 BC	2 BC	1000	2500			1000	
Kea	4 BC	3 BC	1800+800	1500	700	300+400		300
Melos	4 BC	2 BC	2900	1200	1300	400		200
Malta	6 BC	-		7500		-		
Kythera	5 BC	2 BC	3900	1350	900	400		450
Hvar	6 BC	2 BC	4200+800		1900	700	400	
Naxos	5 BC		7200					
Jerba	1 BC	-		2400		-		
Ibiza	2 BC	2 BC	700	2650		650		
Cyprus	10 BC	10 BC	500+3000	6700		800+1000		
Average*			**2443**	**1655**	**665**	**588**	**825 (605***)**	**105**
Average**			**2035**	**3009**	**983**	**839**	**2062 (1642***)**	**300**

Table 7.5. Study 1. Assessing prehistoric vs. historic occupation and abandonment (approximate values)
***Average by island; ** Average by period; ***Without San Domino; N.B. Palmarola and Vulcano not included.**

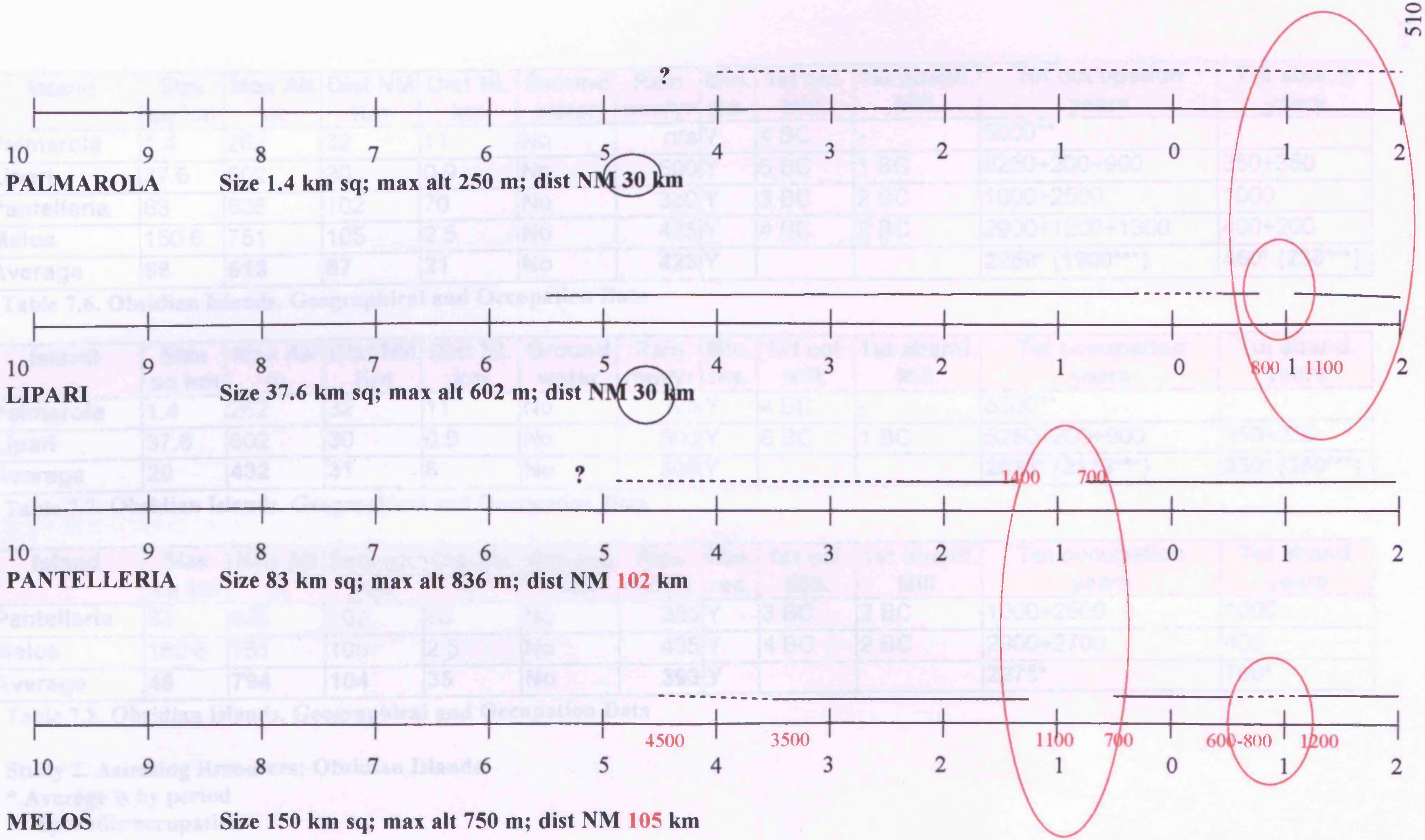


Fig. 7.28. Study 2. Obsidian islands.

Island	Size sq km	Max Alt m	Dist NM Km	Dist NL km	Ground water	Rain mm/yr	Min. res.	1st col. Mill.	1st aband. Mill.	Tot occupation years	Tot aband. years
Palmarola	1.4	262	32	11	No	n/a	Y	4 BC	-	5000**	-
Lipari	37.6	602	30	0.9	No	500	Y	6 BC	1 BC	5250+200+900	350+350
Pantelleria	83	836	102	70	No	350	Y	3 BC	2 BC	1000+2500	1000
Melos	150.6	751	105	2.5	No	435	Y	4 BC	2 BC	2900+1200+1300	400+200
Average	**68**	**613**	**67**	**21**	**No**	**428**	**Y**			**2250* (1900***)**	**460* (238***)**

Table 7.6. Obsidian Islands. Geographical and Occupation Data

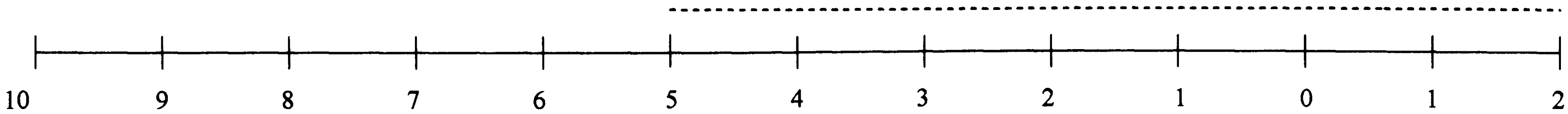
Island	Size sq km	Max Alt m	Dist NM Km	Dist NL km	Ground water	Rain mm/yr	Min. res.	1st col. Mill.	1st aband. Mill.	Tot occupation years	Tot aband. years
Palmarola	1.4	262	32	11	No	n/a	Y	4 BC	-	5000**	-
Lipari	37.6	602	30	0.9	No	500	Y	6 BC	1 BC	5250+200+900	350+350
Average	**20**	**432**	**31**	**6**	**No**	**500**	**Y**			**2838* (2116***)**	**350* (350***)**

Table 7.7. Obsidian Islands. Geographical and Occupation Data

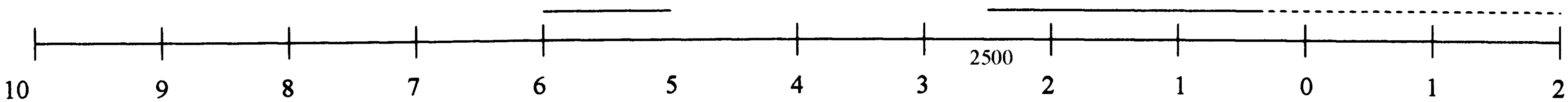
Island	Size sq km	Max Alt m	Dist NM Km	Dist NL km	Ground water	Rain mm/yr	Min. res.	1st col. Mill.	1st aband. Mill.	Tot occupation years	Tot aband. years
Pantelleria	83	836	102	70	No	350	Y	3 BC	2 BC	1000+2500	1000
Melos	150.6	751	105	2.5	No	435	Y	4 BC	2 BC	2900+2700	400
Average	**45**	**794**	**104**	**35**	**No**	**393**	**Y**			**2275***	**700***

Table 7.8. Obsidian Islands. Geographical and Occupation Data

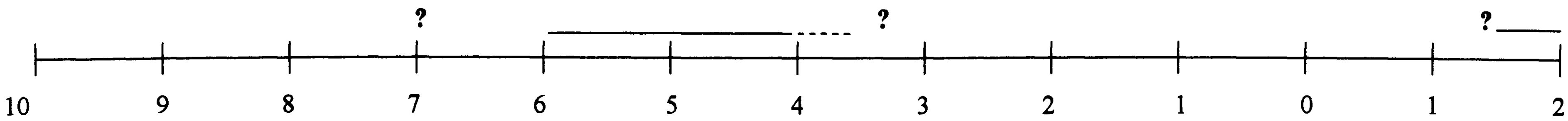
Study 2. Assessing Resources: Obsidian Islands.
*** Average is by period**
**** Sporadic occupation**
***** Without Palmarola**



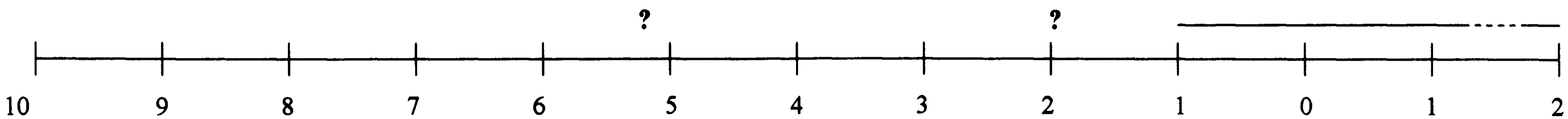
PALMAROLA **Size 1.4 sq km; max alt 250 m; dist NM 30 km**



PALAGRUZA **Size 0.3 sq km; max alt. 90 m; dist NM 130 km**



SAN DOMINO (TREMITI) Size 2 sq km; max alt 116 m; dist NM 20 km



SAN NICOLA (TREMITI) Size 0.4 sq km; max alt 75 m; dist NM 20 km

Fig. 7.29. Study 3. Islands smaller than 10 sq. km (continued on next page)

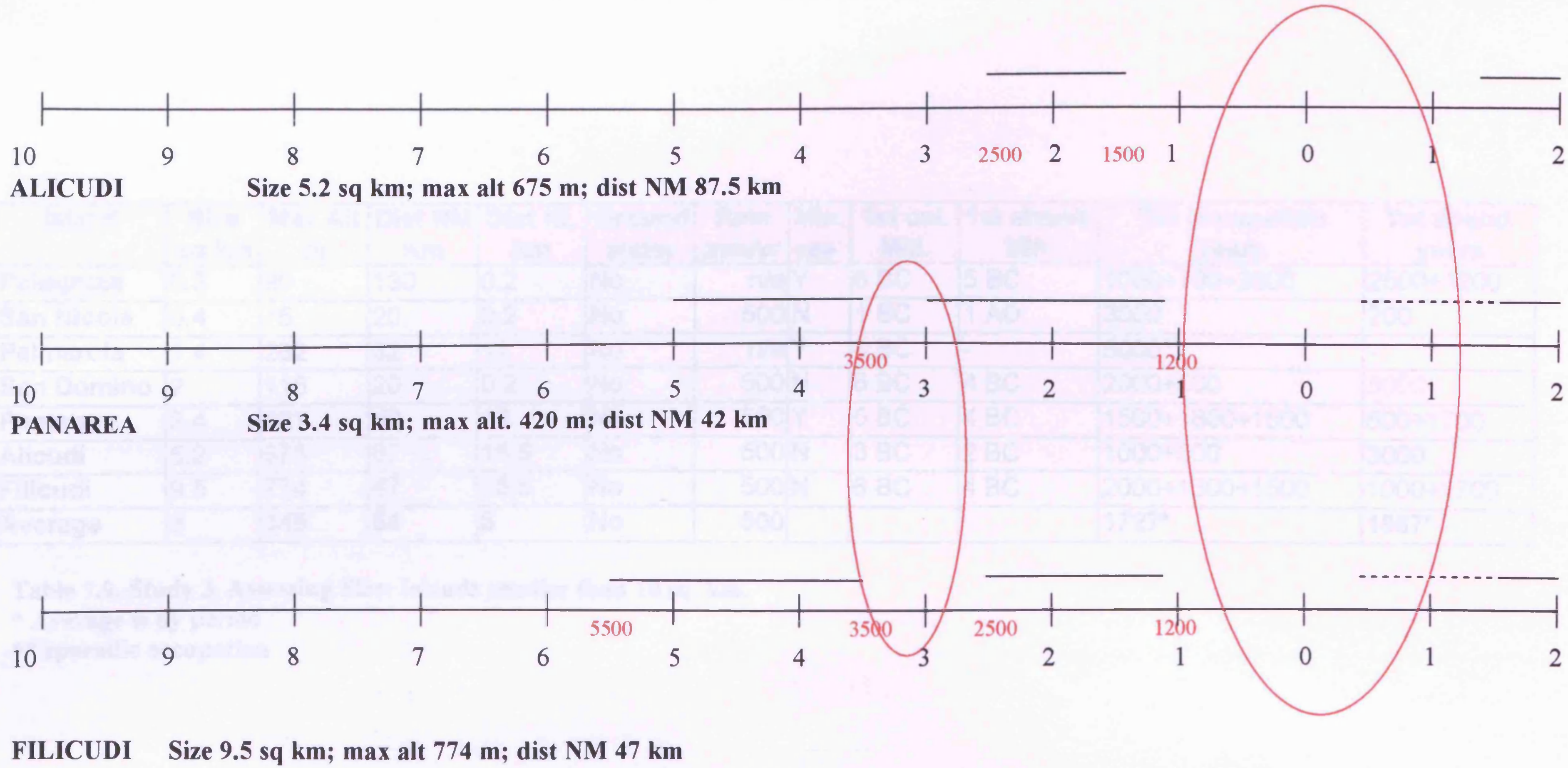


Fig. 7.29. Study 3. Islands smaller than 10 sq. km.

Island	Size sq km	Max Alt m	Dist NM Km	Dist NL km	Ground water	Rain mm/yr	Min. res.	1st col. Mill.	1st aband. Mill.	Tot occupation years	Tot aband. years
Palagruza	0.3	90	130	0.2	No	n/a	Y	6 BC	5 BC	1000+700+2600	2500+1200
San Nicola	0.4	75	20	0.2	No	500	N	1 BC	1 AD	3000	200
Palmarola	1.4	262	32	11	No	n/a	Y	4 BC	-	5000**	-
San Domino	2	116	20	0.2	No	500	N	6 BC	4 BC	2000+500	5000
Panarea	3.4	421	42	14	No	500	Y	5 BC	4 BC	1500+1800+1500	500+1700
Alicudi	5.2	675	87	15.5	No	500	N	3 BC	2 BC	1000+500	3000
Filicudi	9.5	774	47	15.5	No	500	N	6 BC	4 BC	2000+1300+1500	1000+1700
Average	**3**	**345**	**54**	**8**	**No**	**500**				**1727***	**1867***

Table 7.9. Study 3. Assessing Size: Islands smaller than 10 sq. km.
*** Average is by period**
**** sporadic occupation**

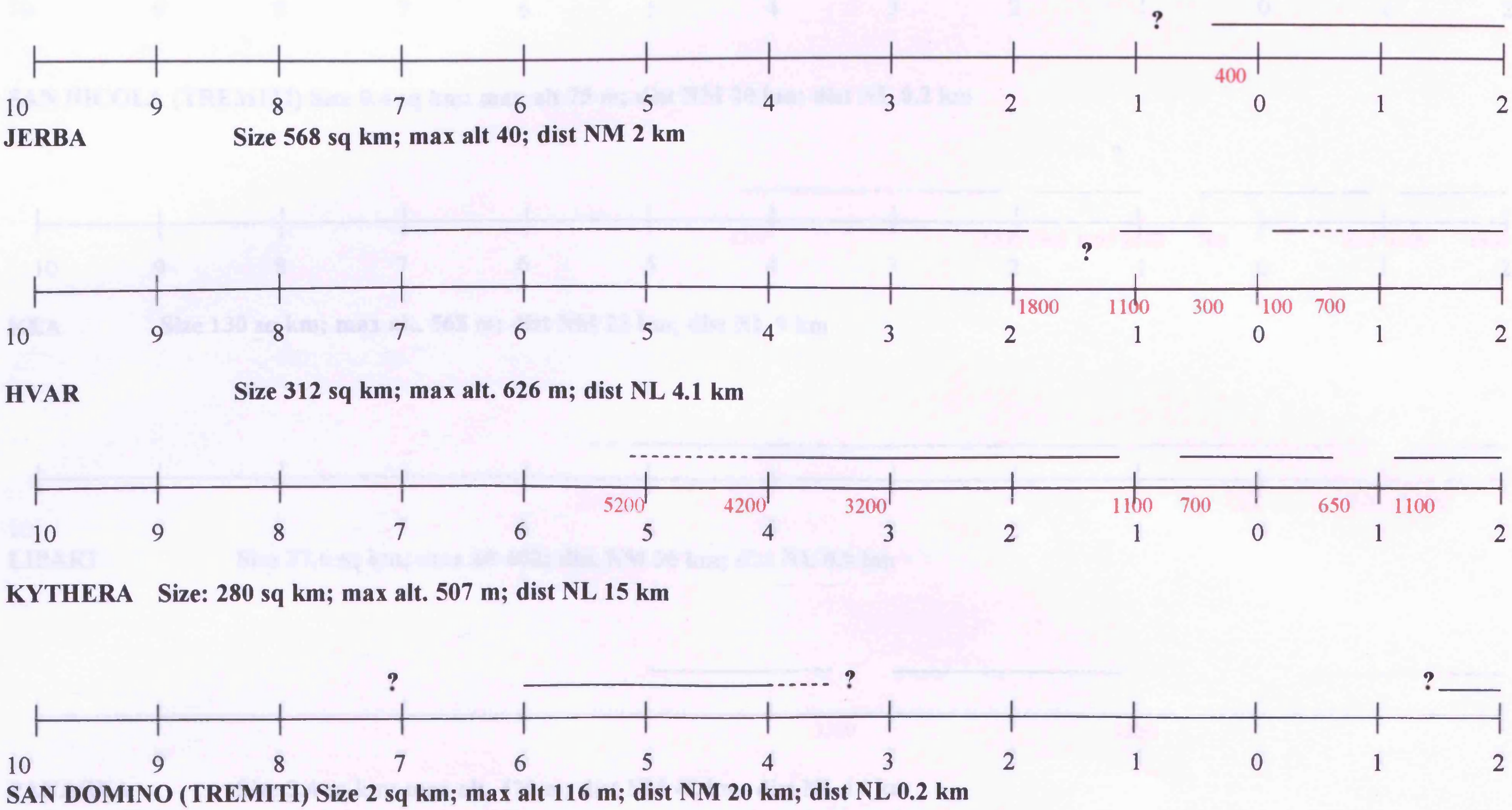
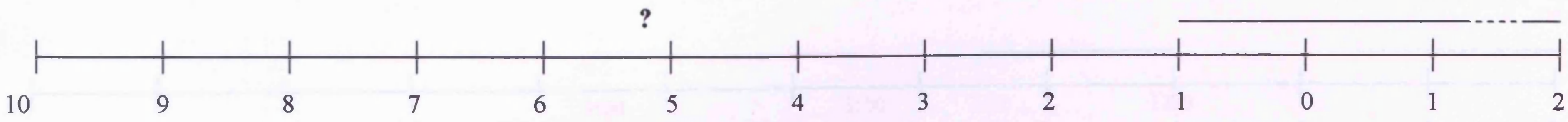
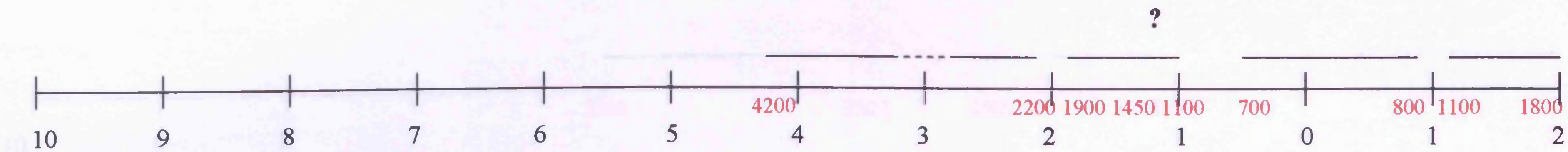


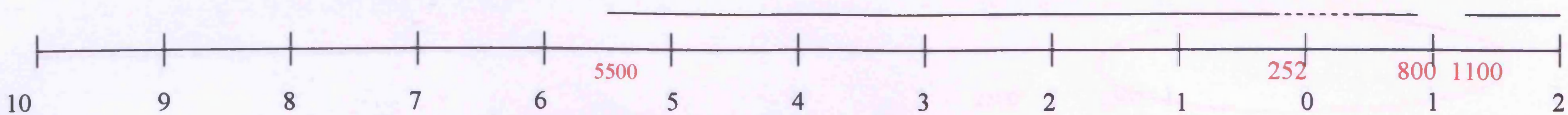
Fig. 7.30. Study 4. Islands with distance to nearest mainland <50 km (continued on next page)



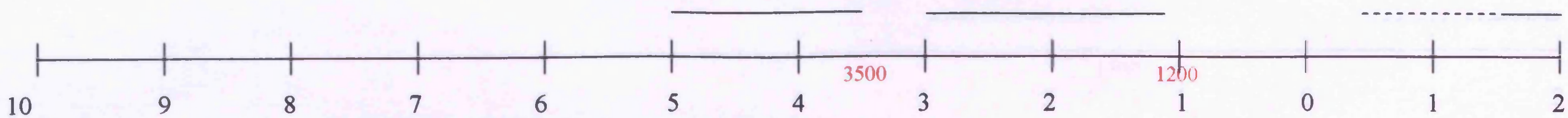
SAN NICOLA (TREMITI) Size 0.4 sq km; max alt 75 m; dist NM 20 km; dist NL 0.2 km



KEA Size 130 sq km; max alt. 568 m; dist NM 22 km; dist NL 9 km



LIPARI Size 37.6 sq km; max alt 602; dist NM 30 km; dist NL 0.8 km



PANAREA Size 3.4 sq km; max alt. 420 m; dist NM 42 km; dist NL 14 km

Fig. 7.30. Study 4. Islands with distance to nearest mainland <50 km (continued on next page)

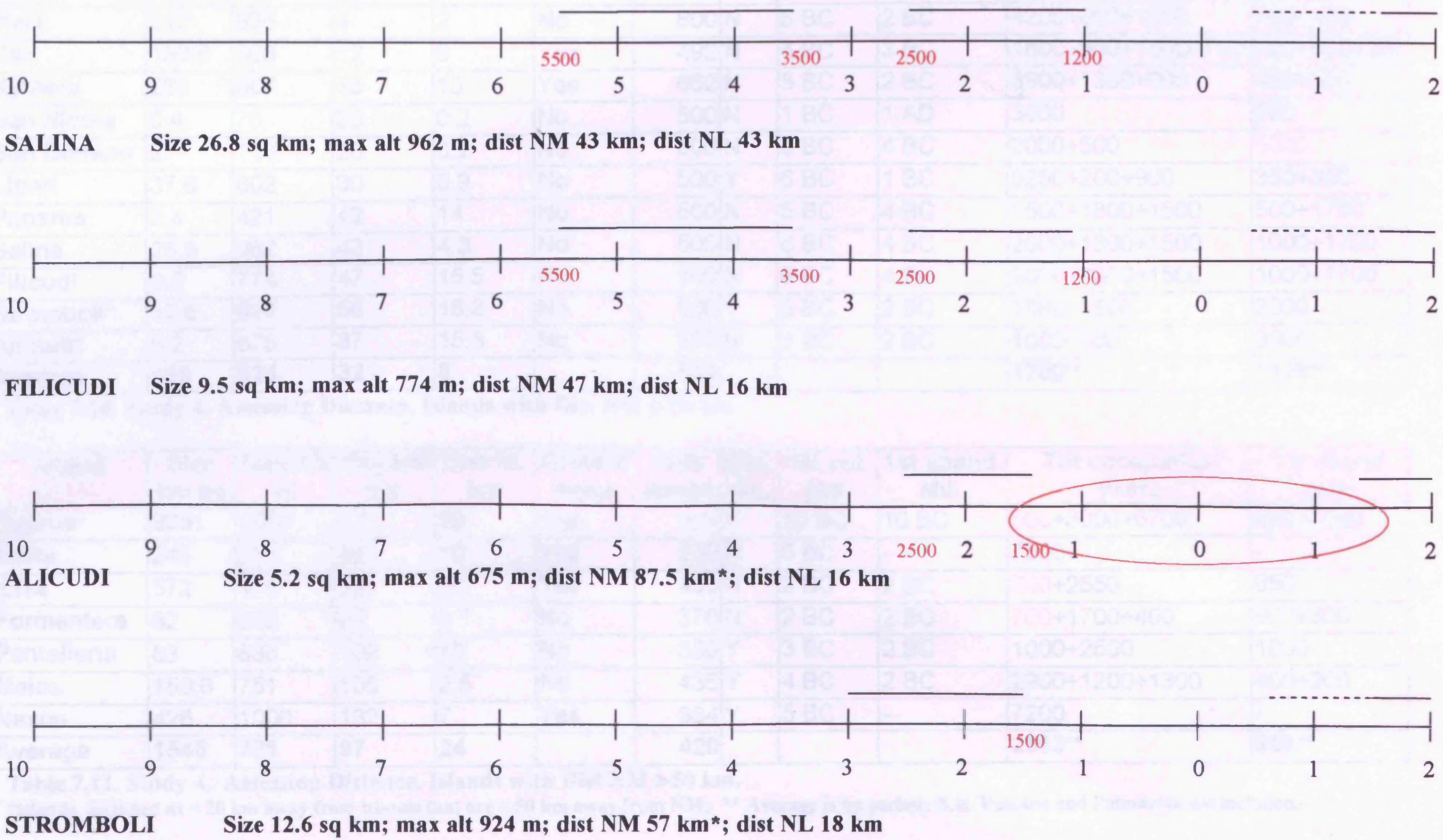


Fig. 7.30. Study 4. Islands with distance to nearest mainland <50 km
*** Alicudi and Stromboli included as less than a day-journey away from nearby Filicudi and Panarea respectively.**

Island	Size km sq	Max Alt m	Dist NM Km	Dist NL km	Ground water	Rain mm/yr	Min. res.	1st col. Mill.	1st aband. Mill.	Tot occupation years	Tot aband. years
Jerba	568	40	2	2	No	200	N	1 BC	-	2400	-
Hvar	312	626	4	2	No	800	N	6 BC	2 BC	4200+800+1900	700+400
Kea	130.6	568	12	9	Yes	492	N	4 BC	3 BC	1800+800+1500+700	300+400+300
Kythera	280	507	15	15	Yes	662	N	5 BC	2 BC	3900+1350+900	400+500
San Nicola	0.4	75	20	0.2	No	500	N	1 BC	1 AD	3000	200
San Domino	2	116	20	0.2	No	500	N	6 BC	4 BC	2000+500	5000
Lipari	37.6	602	30	0.9	No	500	Y	6 BC	1 BC	5250+200+900	350+300
Panarea	3.4	421	42	14	No	500	N	5 BC	4 BC	1500+1800+1500	500+1700
Salina	26.8	962	43	4.3	No	500	N	6 BC	4 BC	2000+1300+1500	1000+1700
Filicudi	9.5	774	47	15.5	No	500	N	6 BC	4 BC	2000+1300+1500	1000+1700
Stromboli*	12.6	924	56	18.3	No	500	Y	3 BC	2 BC	1500+1500	2000
Alicudi*	5.2	675	87	15.5	No	500	N	3 BC	2 BC	1000+500	3000
Average	**116**	**524**	**32**	**8**		**513**				**1700****	**1129****

Table 7.10. Study 4. Assessing Distance. Islands with Dist NM ≤ 50 km.

Island	Size km sq	Max Alt m	Dist NM Km	Dist NL km	Ground water	Rain mm/yr	Min. res.	1st col. Mill.	1st aband. Mill.	Tot occupation years	Tot aband. years
Cyprus	9251	1950	69	69	Yes	500	Y	10 BC	10 BC	500+3000+6700	800+1000
Malta	246	253	85	10	Yes	500	N	6 BC	-	7500	-
Ibiza	572	475	92	3.7	Yes	400	N	2 BC	2 BC	700+2650	650
Formentera	82	202	95	3.7	No	370	N	2 BC	2 BC	700+1700+400	900+300
Pantelleria	83	836	102	70	No	350	Y	3 BC	2 BC	1000+2500	1000
Melos	150.6	751	105	2.5	No	435	Y	4 BC	2 BC	2900+1200+1300	400+200
Naxos	428	1000	132	7	Yes	384	Y	5 BC	-	7200	-
Average	**1545**	**781**	**97**	**24**		**420**				**2663****	**656****

Table 7.11. Study 4.. Assessing Distance. Islands with Dist NM >50 km.

***islands included as < 20 km away from islands that are < 50 km away from NM; ** Average is by period; N.B. Vulcano and Palmarola not included.**